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TRIAL LIGHTING INSTALLATIONS.

Recent advances in methods of calculating artificial illumination have greatly increased the accuracy with which lighting problems may be investigated, but the value of experimental treatment remains as great as ever. It will be a long time before individual judgment based on wide experience gives way to purely mathematical analyses of lighting requirements, just as practice in photography supplements the use of exposure meters and tables. Records of the lighting layout, watts per square foot, color factors and controlling dimensions all play an important part in the selection of lighting apparatus for any installation, but in no field of engineering can one find a better illustration of the established tenet that practically every problem has special limitations requiring special treatment for successful solution.

In meeting these constantly changing conditions, the use of the trial installation is one of the best resources of the engineer responsible for the results. The flexibility of electrical service peculiarly lends itself to variations in the height and spacing of lighting units, the harmonizing of shades and reflectors with color schemes, the adaptation of fixtures to architectural needs, and the comparison of costs by different methods. The wiring of temporary installations is a mere matter of flexible cable or even lamp cord, and the growing use of fixtures supported by chains offers an easy means of studying the height of units—one of the most difficult matters to determine in the solution of general lighting problems. It is, of course, desirable for the architect and the lighting engineer to co-operate in the early stages of building construction rather than at the last moment, and this presupposes a fairly settled location of outlets. The height of the units above the working plane, the type of shades and the style and energy consumption desirable can then be adapted to the conditions even if the outlets are established. In important cases the outlet locations may be left to trial provided the conduit is laid with extra fittings. The point is simply that the trial installation is sometimes the most valuable means of solvng the problem, taking into account the character of the service, the richness of the effects desired and the general standards of architecture to be considered.

The cost of relocating outlets in a single installation on trial is a small matter if thereby the lighting of a large area or the illumination of an entire establishment can be bettered. Fortunately for the

central-station man, the growth of the art of illumination renders the location of outlets comparatively simple, and the bulk of experimental lighting is likely to be along the other lines above indicated. Too much emphasis cannot be laid upon the importance of adequate co-operation between architect and engineer, and the latter should be kept informed as to the details of panelling, ceiling and beam arrangement, proposed use of rooms and changes in the original plans which may modify the lighting installation needed for the best service. In a recent instance the effect of the installation was largely spoiled by the introduction by the architect unknown to the engineer of a panelled ceiling after the lighting units had been selected and approved in conference. Such occurrences should not be permitted, for the introduction of artistic and efficient illumination is as important to the architect as the general scheme of exterior and interior decoration, and the central-station man need make no apology for insisting upon adequate treatment of this important phase of building construction.

SAG ON TRANSMISSION LINES.

The problem of determining the sag on a long span of cable under given conditions is one which has not been worked out in a way to give entire satisfaction. The complete accurate solution to such a problem is a very difficult, not to say impossible undertaking. Various attempts have been made to obtain satisfactory working formulas, but the problem can hardly be said to be solved as yet in a satisfactory manner. Certain assumptions have of course to be made before starting any solution and in any case these will probably not correspond exactly to the facts of the case. If the cable were perfectly flexible it would, if undistorted by either wind or sleet, assume the form of an elastic catenary, since the stretch near the ends of the span is greater than in the center, where the tension is slightly less. It is questionable, however, whether the assumption of this form for the curve of sag corresponds with the facts any more closely than that of the ordinary catenary, and the latter has been assumed in some of the solutions which have been worked out. A parabola, in cases where the span is short or the sag is small, has very nearly the same shape as a catenary curve, and for many purposes it is sufficient to assume that the cable takes this form, since neither curve represents exactly the actual conditions.

On other pages of this issue will be found a solution by Professor W. T. Ryan, of the University of Minnesota, in which the assumption of a parabolic curve is made. Even with this modification, calculations are not entirely simple if one is to consider the change of length with temperature and the elastic shortening and lengthening which accompanies the change of tension due to expansion and contraction by temperature. Professor Ryan has shown how, by a series of successive approximations, a solution which is approximately correct can be obtained, while taking these effects into consideration.

This solution, like all others, involves certain assumptions, one of which is the shape of the curve taken by the cable and a second is the use of only an approximate formula for the length of cable in a given length of span, where the curve is assumed to be parabolic. Even if the solution were accurate, however, it is never very satisfactory to solve a problem by the method of trial, as is done in this case, since repeated computation becomes rather burdensome. It would seem that this is a suitable problem to which to apply the method of nomogrammatic diagrams, such as were used in our last issue by Mr. Eichhorn in the case of finding the drop in voltage in an alternating-current line. This method has peculiar advantages over ordinary computation in any problem where successive trials must be made in order to achieve a solution, and we suggest that those whose work involves the computation of sags should apply the nomogram to the solution of this problem. When the necessary scales have once been laid out the main part of the work is done, and the values for any given case can then at any time be read off with very little labor. Moreover, the method and formulas used may be as exact as is possible and desirable, since any complicated computations need to be made but once.

THE RATIO OF TRANSFORMERS.

Now while the Standardization Rules of the American Institute of Electrical Engineers are undergoing revision it would be a good time for a more definite understanding as to what is meant by the expression "the ratio of a transformer." In the earlier days, and to some extent even yet, this term is used in a rather loose way and sometimes without any definite quantitative meaning. Since, excluding leakage, the induced voltages in the windings of a potential transformer are proportional to the numbers of turns respectively, the ratio when used approximately is taken to mean the ratio of the number of turns. Even here, however, there is some divergence in usage, certain authors using the ratio of primary to secondary turns and others the ratio of secondary to primary turns. The same is true of the current transformer.

In using the term exactly also, some authors still cling to the ratio of turns, but this is not customary in practical work. In practice men are usually concerned with terminal voltages and these, owing to resistance and leakage reactance, differ from the voltages induced by the changing magnetic flux. These terminal voltages are consequently not in the same proportion as the numbers of turns. In using instrument transformers for measurements, it is the ratio of terminal voltages which is of importance for the potential transformer and the ratio of currents for the series transformer. In order to get

simple ratios of these quantities it is customary for the manufacturer to slightly alter one of the windings from the number necessary to give the nominal ratio of turns. The ratio of turns is not indicated on the name plate and is generally unknown to the user. The name plate should, and usually does, tell the ratio of terminal voltages or the ratio of currents under definite conditions of use.

Since changes in the conditions of use, such as load, frequency, etc., produce slight changes in the ratio of terminal voltage or of currents, the question arises as to whether the ratio of a transformer should be so defined as to have a constant value for a given transformer or should depend upon the conditions of use. Should it represent a quantity the value of which is secreted in the archives of the manufacturer or one whose value can be determined by a simple measurement?

Since it is important to use this term in a quantitative sense, especially with relation to instrument transformers, it should have a definite quantitative meaning, and this should be included in the Standardization Rules of the American Institute. The definition should be one which will make the expression most useful to the engineer, and it seems that the ratio of terminal voltages for the potential transformer and the ratio of currents for a current transformer have this qualification. These definitions make the ratio a variable quantity depending upon the conditions in the secondary circuit. The regulation is then the change in ratio between full load and no load expressed as a percentage of the ratio at full load.

As to whether step-down transformers should be said to have a ratio greater or less than unity, general practice seems to be to use the ratio greater than unity in this case. A step-up transformation is then expressed by a fractional ratio. This is especially true in regard to the current ratio of series transformers. These are nearly always step-down transformers and the ratio as used and as marked on the name plates by the manufacturers is always a number greater than unity. The ideas conveyed by the several expressions "transformation from 100 amperes to 5 amperes," "transformation in ratio of 20 to 1," "ratio of transformation 20 to 1," "ratio 20:1," seem to suggest the evolution of the term and should all express the same meaning. It would be confusing to use the last expression to mean the reverse of the first.

Yet advocates are to be found for the notion that the ratio should be stated as the ratio of the number of secondary turns to the number of primary turns. If there are any good reasons for this use of the term it would be well to have them presented, and the Institute should decide upon one or the other as a definite usage to be generally followed. Only confusion and haziness of ideas are promoted by the present use of the term in different senses by different people.

HIGH-SPEED TURBO-ALTERNATORS.

The introduction of the steam turbine as a prime mover necessitated a radical change in the design of electric generators to be driven by them. The high speed necessary for the efficient operation of the steam turbine involves radical changes from previous mechanical construction and the compactness of design introduces difficulties in securing the dissipation of the large amount of heat which must necessarily be developed in a small space. The subject has been fully discussed by Mr. B. G. Lamme at the recent meeting of the American Institute of Electrical Engineers, a report of which will be found upon other pages of this issue. That the subject was thoroughly covered by Mr. Lamme is evidenced by the fact that the discussion brought out little additional information, but it naturally developed differences of opinion which exist among different designers and users of such machines in regard to working temperatures, the use of external air blowers, the details of ventilation and of insulation, etc.

The modern turbo-alternator is a machine with stationary armature, and revolving field consisting usually of two poles but having four poles in some designs of 60-cycle machines for high capacities. In the revolving field the flux is not reversed, but in the armature core it is and it is here that the greatest heat is developed and the necessity for extensive ventilation is met. The figures given for the volume of air necessary to carry away the heat which is unavoidably developed will astound one who is not familiar with this work. It is probable also that the temperatures which usually exist within such armatures of high-capacity machines will come as a surprise to many. We have Mr. Lamme's word for it that many machines which are supposed to be not exceeding a temperature of 90 or 100 degrees centigrade in reality contain hot spots not lower than 125 degrees.

Perhaps the more surprising part of it is that some of these have fibrous insulation and yet continue to run without breakdown. The practical necessity for these higher temperatures, has, however, led to the general introduction of mica insulation in the latest machines, and the tendency seems to be to deliberately permit these high temperatures. Probably even higher temperatures will soon be recognized as allowable, when it has been demonstrated that the insulating materials will not thereby be deteriorated. The fact that higher local temperatures are often not discovered by the usual methods of temperature measurement shows the uselessness of specifications which limit operating temperatures to the ordinary values, when the performance tests do not include any means of discovering the actual temperatures. However, with the better heat-resisting insulation there is no object in limiting temperatures to the lower values even were test methods adopted for exactly determining them.

Annual Meeting, Illuminating Engineering Society.

The annual meeting of the Illuminating Engineering Society was held at the Aldine Club in New York City on the evening of January 10. A dinner preceded the meeting, at which about 75 members and guests were present. President V. R. Lansingh presided. Several representatives of a number of societies with which the Illuminating Engineering Society has established co-operative relations were present and addressed the meeting. Among these were W. R. Addicks, president of the American Gas Institute; J. W. Lieb, Jr., chairman of the Lamp Committee of the Association of Edison Illuminating Companies; T. C. Martin, secretary of the National Electric Light Association; W. H. Tolman, director of the American Museum of Safety. Addresses were also made by Past Presidents C. H. Sharp and L. B. Marks.

President Lansingh then made his retiring address, in which he reviewed the work of the Society for the past year and reported gratifying growth in its activities and excellent prospects for its future. A report of the Committee of Tellers on the letter-ballot election of officers was then presented, and the following were announced duly elected as officers for the year 1913: President, Preston S. Millar; general secretary, Joseph D. Israel; treasurer, L. B. Marks; vice-presidents, J. W. Cowles (for the New England Section), W. J. Serrill (Philadelphia Section), H. S. Evans (Pittsburgh Section), J. R. Cravath (Chicago Section); directors, P. W. Cobb, C. O. Bond and W. Cullen Morris.

Announcement was made that the letter ballot on the constitutional amendments, which had been submitted simultaneously with the ballot for the election of officers, had resulted in the approval of all the proposed amendments. Of these the most notable are three: (1) a change of the fiscal year, to begin with October instead of January; (2) provision for the appointment of local representatives in various cities in which there is no section of the Society; (3) provision for sustaining members, composed of lighting companies, manufacturers and others interested in furthering the work of the Society.

The meeting was then turned over to the incoming officers, and addresses were made by President Millar and Secretary Israel. In his inaugural address Mr. Millar reviewed the main features of the Society's activities of the last seven years, pointing out that in the first four years the Society's work was devoted chiefly to perfecting its organization, improving its internal mechanism and developing its function as a forum for discussion. The last three years have been devoted to a broadening of the activities of the Society outside itself chiefly through educational efforts. The three main functions of the Society are, first, to serve as a forum for the presentation and discussion of technical questions pertaining to light and illumination; second, to improve lighting practice through the formulation and application of the principles of good illumination and through the education of lighting practitioners and the public at large; third, ultimately to establish a professional basis for illuminating engineering. The first two functions have already been well started. Practically no effort has been made as yet to promote the third function of the Society, because the time is probably not yet ripe for such effort. As a forum the Society is concerned with the science of illumination, and it was therefore only logical that its early work was predominately of this character. The later years of the Society's work have been concerned more with the art of illumination, and this feature must be further promoted by extension of educational work and a general policy of expansion. The greatest needs of the Society at the present moment are (1) increased knowledge of the architectural and decorative requirements of any illumination design; (2) extension of educational work in various forms; (3) successful application of the new constitutional provisions for expanding the influence of the Society. Mr. Millar therefore urged the active co-operation and further support of the officers, committees and members which had already made possible the great developments of the first seven years of the Society's work.

Rathenau Medal Awarded to Edison.

The new Rathenau medal, for the best device or process in the electrical industry for safeguarding industrial life and health, will be awarded to Thomas A. Edison on Thursday evening, January 23, by the American Museum of Safety.

The inventions for which Mr. Edison will get the medal are the result of his application of the storage battery as a safety device in work in mines, tunnels, under water, as in submarine boats, in factories where explosives are made, powder magazines, and where explosive gases are generated or in use.

The establishment of this medal was announced in our issue of September 14, 1912. It was presented by the German Emperor to Emil Rathenau, president and founder of the Allgemeine Elektricitäts Gesellschaft, and by the latter placed at the disposal of the American Museum of Safety, which will award yearly a replica of the original.

Mr. Edison will be the first recipient of the Rathenau medal in this country.

Progress of Colorado Electric Club.

At the regular weekly luncheon of the Colorado Electric Club, held at the Albany Hotel, Denver, on January 12, four new directors to serve for three years were elected. The new directors are W. J. Barker, general superintendent of the Denver Gas & Electric Light Company; L. M. Cargo, Westinghouse Electric & Manufacturing Company; W. F. Cozad, traffic manager of the Mountain States Telephone & Telegraph company; and W. H. Macaloney, superintendent of motive power of the Denver City Tramway Company. In a few days a meeting of the new directors will be held at which time officers for the coming year will be named.

A review of the progress made by the club during 1912 brings to light some very interesting facts concerning the electric industry. A membership of 727 is now credited to the club, the increase during 1912 being 400. These members are scattered throughout the state. In addition the club has taken rank with some of the most progressive organizations of the city, and whenever a state or city up-building movement is inaugurated members of the Electric Club are always appointed to serve on the various committees. In connection with electrical matters the club has been foremost in constantly keeping the public in touch with the industry and it has worked for the establishment of co-operation between the members of the electrical trade in Denver. That a better feeling has been established is the opinion of everyone who has come in contact with the club.

Among the notable happenings of 1912 was giving the Electric Club membership in the United States Chamber of Commerce. It has also been closely identified with the other civic and commercial organizations of Denver.

Denver Railway Statistics.

Figures announced by the Denver City Tramway Company for 1912 show that 226 miles of street railway in Denver, Colo., or practically one mile for every 1,000 of population, is operated over by passenger conveyances. A total of 81,639,113 passengers, including approximately 16,000,000 transfer passengers, were carried during the year. The gross receipts for the year were $3,419,519. After paying all operating expenses, franchise charges to the city, taxes and all other fixed charges the income of the company amounted to $543,559.

Preston S. Millar.

Preston S. Millar, who has just been elected president of the Illuminating Engineering Society, has for the past seven years contributed a wealth of information to the subject of illuminating engineering, and although a young man, has had a very impressive influence on the establishment of this phase of engineering as an exact science. He has been connected with the testing enterprise, now incorporated under the name of the Electric Testing Laboratories, in New York City, since shortly after its inception in 1896. He has never been associated with any other company or commercial enterprise. He is in charge of the department of lamps and lighting, his chief work being tests of incandescent electric lamps for purchasers, largely members of the Association of Edison Illuminating Companies. These tests cover one of every five incandescent electric lamps made in the country. Other tests carried out under his direction include all kinds of illuminants, gas, electricity, etc., as well as tests of lighting auxiliaries and of illumination. In addition to his technical work he is assistant manager and secretary of the company.

He has contributed a great number of papers to the proceedings of the Illuminating Engineering Society and the Association of Edison Illuminating Companies, and has been a prolific contributor to the technical press. In March, 1909, he gave a special lecture in the course of the New York Edison Company on "Photometry" and "The Application of Photometry to Industrial Lighting Practice." In the same month he delivered a lecture before the Electrical Engineering Society of Columbia University on "Photometry." In February, 1910, he delivered a lecture before the Fort Wayne branch of the American Institute of Electrical Engineers on "Recent Developments in Illuminants," and repeated this lecture the same month to the Chicago Section of the Illuminating Engineering Society. In October, 1911, he delivered a lecture on "Commercial Photometers," in the General Electric Company's lecture course. At the joint meeting of the National Electric Light Association and the Illuminating Engineering Society, November 18, 1912, he delivered a lecture on "Illumination of Interiors," with a demonstration by the aid of miniature rooms.

He was associated in October, 1910, with H. E. Ives and C. O. Bond in the conduct of the laboratory course in conjunction with lectures on illuminating engineering given at the Johns Hopkins University under the joint auspices of the University and the Illuminating Engineering Society.

With C. H. Sharp he is the joint inventor of the Sharp-Millar universal photometer. He is also the joint inventor with Dr. Sharp of a simple illuminometer, and in collaboration with Dr. Sharp has promoted the use of the integrating sphere (invented by Ulbricht) in this country. With Dr. Sharp he is also the joint inventor of a particular design of sphere and of a lamp-handling device which renders the sphere practicable for commercial work.

Preston S. Millar,
President of the Illuminating Engineering Society.

He is a charter member of the Illuminating Engineering Society, and was secretary of the New York Section from 1906 to 1908, and general secretary from 1909 to 1912. He is an associate member of the American Institute of Electrical Engineers and of the American Gas Institute. He is also a member of the National Electric Light Association, the New York Electrical Society and of the Association of Railway Engineers. He is treasurer and business manager of the committee on organization of the International Electrical Congress. He was also chairman of the section development committee of the Illuminating Engineering Society, 1911 and 1912, and has been a member at various times of special committees and of the standing committees on papers, editing, publishing, financial policy, etc. He was a member of the 1910-1911 National Electric Light Association committee on ornamental street lighting; 1911-1912 advisory committee on street lighting, and a member of the 1912-1913 committee on street lighting. He was subeditor on illuminating engineering for the revision of the National Electric Light Association "Question Box," covering the period from 1902 to 1909. He was a member of the committee on standard specifications for incandescent lamps as drafted jointly by manufacturers and government engineers in February, 1907.

Reducing Smoke in Boston.

In a communication to the Boston daily newspapers on the subject of the smoke nuisance, now under discussion in that city, L. D. Gibbs, superintendent of advertising of the Boston Edison Company, states that notwithstanding the remarkable increase in the amount of business and electric current generated by the company, and the consequent consumption of coal, in the last ten years, the emission of smoke from the chimneys of the generating stations has been steadily diminished. The improvements now under way at the South Boston station will bring the emission of smoke far lower than the requirements of the law call for. The company will have spent by next Autumn between $180,000 and $200,000 in the installation of devices in connection with the coaling of 28 boilers. The concentration of current generating and the doing away with small plants also works for the relief of traffic congestion in hauling coal.

Ithaca Section Banquet.

The sixth annual banquet of the Ithaca Section of the American Institute of Electrical Engineers was held in Sibley Dome, Cornell University, on Saturday evening, January 11. The principal speakers were Ralph D. Mershon, president of the Institute, and J. L. Harper, chief engineer of the Niagara Falls Hydraulic Company.

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION.

Address by President Ernest Freeman.

At the regular Thursday noon meeting of the Electric Club of Chicago, January 9, Ernest Freeman, president of the National Electrical Contractors' Association, spoke of the growth and work of this important organization. Mr. Freeman said that the Association was formed in 1901, with 31 members. Of these charter members 26 are still in the Association, two have died and three have gone out of the contracting business. The present membership is approximately 1,250.

The speaker then explained that the Executive Committee of the Association meets four times each year for the transaction of business. This committee reports its work to the Board of Directors and makes such recommendations to the Board as seem desirable. The latter body reports to the Association itself at the annual conventions held every summer.

Speaking of some of the things the Association has done to promote facility in electrical construction and to make the daily tasks of the electrical contractor less burdensome, President Freeman said that until the Association took the matter in hand there was no uniformity of practice in the matter of wiring symbols, as these are used in the specifications of architects and others. For example, in one set of plans a switch or a receptacle might be indicated by a symbol entirely unlike that used in some other set of plans. Standard symbols have now been adopted, however, and the use of them is fast becoming general.

The speaker stated that the Universal Data and Sales Book was one of the best pieces of work of the Association up to this time. This book contains manufacturers' wholesale prices and discounts on the materials of electrical construction. The sheets are revised regularly by the manufacturers themselves. The book also contains re-sale prices, but these are simply recommendations as to what appears to be reasonable prices for the contractor to charge for the goods he sells, and the contractor may adopt these selling prices or decline to do so, as he sees fit.

The Universal Data and Sales Book contains reliable information as to electrical inspection rules in various cities and towns, electricians' wages in those places, hours of work, etc. There are rules, too, for figuring overhead charges, and a great deal of other data of exceptional value to the contractor.

Mr. Freeman showed a set of the conduit charts which the National Electrical Contractors' Association has lately completed. By means of these, the size of the conduit needed for any given number of conductors of any given size in any system of circuits can be easily determined.

The National Association has a representative on the Electrical Committee of the National Fire Protection Association, which committee has charge of revising the National Electrical Code from time to time. The assistance of this representative in revising the Code is something the other members of the Electrical Committee have come to appreciate very highly.

The Standardization Committee is another important committee of the National Association. The aim of this committee, it was explained, is to introduce more complete standardization in the design of electrical fittings and fixtures. There is a Legislative Committee also, which collects the laws of the various states relative to electrical construction and contracting.

Special mention was made of the *National Electrical Contractor*, a monthly journal which the National Association publishes. It was stated that the recent growth of this publication, especially in its volume of advertising, had been very pleasing.

In his closing remarks, Mr. Freeman referred to the prominence of the National Electrical Contractors' Association in the recently organized Society for Electrical Development, and also cited some fine illustrations of the growing tendency on the part of the electrical contractors to co-operate heartily with one another in the promotion of the contracting business.

Annual Meeting of the Western Society of Engineers.

The forty-third annual meeting of the Western Society of Engineers was held at Chicago on the evening of January 8. As usual, several other features were held in connection therewith. During the afternoon of January 8 an inspection trip was made on a special train to the new Northwest power station of the Commonwealth Edison Company. A large party made this trip. The afternoon of January 9 was devoted to inspection of the large new works of the Corn Products Refining Company at Argo, Ill., a special train being provided for this trip also. On Thursday evening a smoker, with music, story telling and other light entertainment, was given in the rooms of the society in the Monadnock Block.

A sumptuous dinner preceded the annual meeting proper, which was held in the Louis XVI banquet hall of the Hotel Sherman and attended by nearly 200 members and guests. Excellent music intervened the early part of the festivities. Secretary J. H. Wardner opened the formal part of the program by reading abstracts of his annual reports, in which he pointed out the flourishing condition of the society in membership, finances and influence, dwelt on the year's activities and called particular attention to the society's library and its monthly *Journal*.

W. C. Armstrong then made the annual address of the retiring president, in which he reviewed many features of the society's work and urged the taking up of a movement for abstracting engineering papers and literature for the benefit of the busy engineer. He announced the award of the Octave Chanute medals for the best papers presented in 1911 dealing with civil engineering, mechanical engineering and electrical engineering. These were awarded, respectively, to John Ericson, H. Gansslen and C. F. Burgess.

The results of the letter ballot for election of officers for 1913 were announced as follows: Albert Reichmann, president; A. Bement, first vice-president; B. E. Grant, second vice-president; John F. Hayford, third vice-president; C. R. Dart, treasurer; F. E. Davidson, trustee for three years.

Mr. Reichmann then assumed his new presidential duties by making a brief inaugural address. In this he called attention to the unique place that the society holds and to the need for continued expansion of its influence and activities, pointing out some lines in which much useful work can be done. He also looked forward to the time when larger and more commodious quarters would be needed.

The meeting was then turned over to Judge Charles S. Cutting of the Cook County Probate Court, who acted as toastmaster for the remainder of the evening. A scholarly address was made by Emory R. Johnson of the University of Pennsylvania on the topic, "Panama Traffic and Tolls." Dr. Johnson considered the legislation exempting American coastwise vessels from Panama Canal tolls as unwise, pointing out many reasons why it is illogical, unfair and will be entirely ineffectual in accomplishing the results anticipated.

Charles H. Wacker, chairman of the Chicago Plan Commission, made an illustrated address on the work of that organization. He showed many slides of Europe and American city views that illustrated the great strides made in city planning abroad.

The meeting was brought to a close by a short but feeling address made by Clarence B. Strouse, who spoke on the disappearance of sectional feeling between the different parts of the country.

Electrical Drive of Kettles in Plaster Mills.

By A. E. Anderson.

In the issue of October 12, 1912, data and information were given on power requirements of plaster plants using gypsum as the raw product. Large quantities of plaster are made in the West, however, from gypsite, which appears in an entirely different form from gypsum. As the writer has just completed some tests in a plant in Southern Wyoming using gypsite, he is passing them along with the hope that they may be of use to power companies in other localities.

The method of manufacture from two raw products is quite different in the preparation of the raw product, and the power requirements in the calcining stage are, apparently, very different.

In the case of gypsum, the processes of quarrying and crushing must be gone through with, while gypsite appears in nature as a dirt that needs no treatment whatever before it is put into the kettle for calcining.

In the calcining operation, the moisture is evaporated by fires under the kettle while the mixture is being agitated by the paddles. In the mills in our territory the kettles are of ten tons capacity, requiring, in the case of individual drive, 25-horsepower motors. The power required during this evaporation process is but 5 horsepower, meaning a low load-factor for this portion of the cycle which last from 3 to 3.5 hours. The plaster at this stage bubbles and flows about in the kettle in a manner very similar to a bubbling spring.

The temperature of the kettle during this stage of the processes is never allowed to get lower than 250 degrees Fahrenheit, the fires being kept as hot as possible during the entire cycle. The raw stuff is fed from a spout at such a speed that the temperature never gets lower than this figure and, obviously, the time per cycle depends on the condition of the dirt—snow, rain, etc.—and the condition of the fire, which latter is also dependent on the kettle bottom. As these burn out occasionally, they are made with seams and it is these seams that open up and allow the plaster to sift through, seriously affecting the fire conditions.

After the first evaporation takes place, a chemical change comes about and a second dehydration then takes off the second portion of moisture. The plaster sinks in the kettle and the power jumps from 5 to 30 horsepower, this period lasting from 20 to 30 minutes or longer, depending on the condition of the fire and the kettle bottoms. A slow fire, due to either poor coal or a leaking bottom, prolongs this "going-down" period, as it is called, and increases the total power consumed appreciably, as it occurs when the power demand is at its heaviest.

When this chemical change is completed, the plaster again rises to the top of the kettle and the kettle gains steadily in temperature until 380 degrees Fahrenheit is reached, when the plaster is ready to dump. Allowing the temperature to rise higher than 380 degrees means burned plaster, unfit for use, and this must be watched very closely.

From the standpoint of the small central station, this load is not the most ideal, as during the larger portion of the cycle, the power is very low and the shorter portion is accompanied with a peak of six times the normal load. This peak comes on very rapidly, inside three or four minutes and goes off as suddenly. This precludes running a small unit at near full load, as the load comes on so suddenly that another unit cannot be switched in in time to provide for the increased load. As the mills operate into November and December, the "going-down" peak comes on the station lighting peak, making the prospect still less desirable. But the smaller stations need every bit of load they can corral; so too stringent a line cannot be drawn.

However, the auxiliary machinery, as the elevators, conveyors, fiber-picking machines, and the sacking department run long hours at a fairly good load-factor, thus helping out the over-all load-factor considerably. In modern lay-outs, the plaster is stored before it is sacked and the orders filled and placed direct in the cars without a second handling. This means operation of the sacking department weeks after the mill proper is shut down and proves an excellent central-station load.

Eight kettles were pulled through during the tests. The tests were run at a time when snow was melting on the ground, so that excessive moisture in the raw product prolonged the time required per kettle longer than average. This, coupled with poor coal and a leaking kettle bottom that put out the fires several times, makes the results higher than they would be under average operating conditions.

The results of the tests are as shown in Table I. Table II shows results for the three days separately. The results

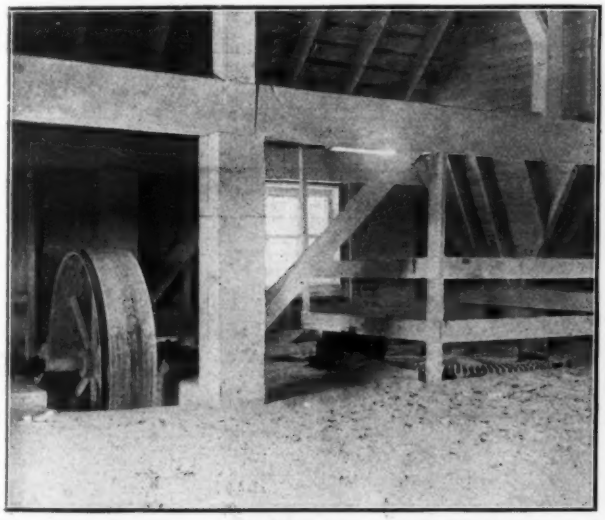


Fig. 1.—Gear and Pinion Driving the Paddle Shaft.

Fig. 2.—Idler on Belt Running Up to Gear Shaft.

reduced to a tonnage basis are shown in Table III, while Table IV shows the same for the three days.

The first day's tests of two kettles were made on a Saturday after the kettle had been cold for two or three days. This starting up cold seems to prolong the time period and cause a larger consumption of power. Monday's results on three kettles after a shutdown over Sunday, show similar conditions. The tests on the three kettles on the third day are more nearly average for five out of six operating days and were used to base probable monthly power bills on.

The power demands of the kettle during the entire cycle are as shown in Fig. 5. The maximum here shown is only 25 kilowatts, which was the limit of reading of the wattmeter. The maximum peak was, however, determined from the ammeter readings to be 30 kilowatts.

Fig. 1 shows the gear and pinion driving the paddle shaft. Fig. 2 shows the idler on the belt running up to the gear shaft. The paddle shaft can also be seen to the right. Fig. 3 shows the bottom part of the kettles. The fire doors are to the left.

Fig. 4 shows the kettle tops and the platform where the operators stand. The levers in the foreground are used for dumping the kettles. The trough used for filling is seem at the extreme right. The stack on the left conveys the vapor and moisture to the atmosphere.

TABLE I.

		Time			Kilowatt-Hours.				
Date	Test	Fill and Cook	Going Down	Total	Fill and Cook	Going Down	Total	Tons of Plaster	Conditions
16	1	4:35	30	5:05	31	9	40	10	Start—cold kettle
16	2	3:09	30	3:39	20	9	29	7	
18	3	3:35	21	3:59	22	7	29	7	Start—cold kettle
18	4	3:43	25	4:08	21	4	25	7	Belt relaced
18	5	3:06	24	3:30	22	5	27	6	
19	6			3:56			30	9	Fire not good
19	7			3:57			28	8	Dirt very wet
19	8			3:45			20	6	

TABLE II.—AVERAGES OF TOTALS BY DAYS.

Date	Time	Kilowatt-Hours	Tons
16	4:22	34.5	8.5
18	3:52	27	6.67
19	3:53	26	7.67

TABLE III.—RESULTS REDUCED TO A TONNAGE BASIS.

		Time			Kilowatt-Hours			
Date	Test No.	Fill and Cook	Going Down	Total	Fill and Cook	Going Down	Total	Tons
16	1	27.5	3	30.5	3:10	0.9	4	10
16	2	27	4.3	31.3	2.86	1.29	4.15	7
18	3	31	3	34	3:14	1.00	4.14	7
18	4	32	3.5	35.5	3.00	0.57	3.57	7
18	5	31	4	33	3.67	0.83	4.50	6
19	6			26			3.33	9
19	7			29.5			3.50	8
19	8			37.5			3.33	6

TABLE IV.—RESULTS REDUCED TO TONNAGE BASIS PER DAY.

Date	Time per ton	Kilowatt-Hours per ton	Tons handled
16	31	4.06	17
18	35	4.05	20
19	30	3.38	23

Fig. 3.—Bottom Part of Kettles With Fire Doors to Left.

Fig. 4.—Kettle Tops and Platform Where Operators Stand.

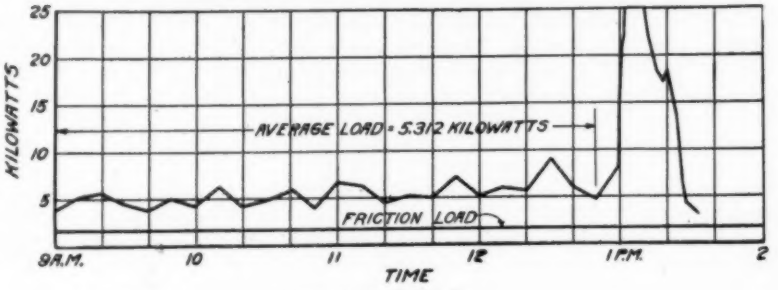


Fig. 5.—Load Curve.

Brazilian Wireless Station.

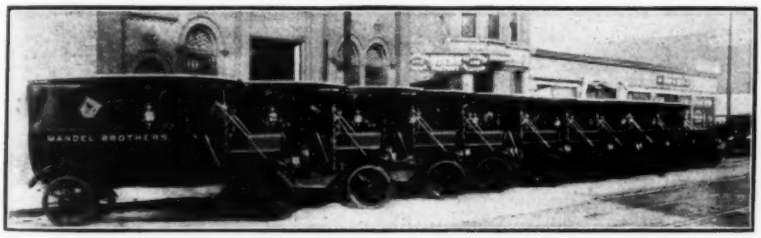
The President of Brazil has signed a decree authorizing the minister of public works to open a credit of $50,000 for expenses connected with the installation of a stategic radiotelegraph station at Cape St. Thome, to the north of Cape Frio.

Commercial Practice
Management, Rates, New Business

Electric Vehicles Provide Prompt Christmas Deliveries.

One of the pleasant things connected with the recent holidays was the great improvement brought about in the delivery service of many large department stores by the use of electric delivery wagons. Among these establishments were two whose delivery performance has particularly come to our notice. These are the great establishments of Mandel Brothers, in Chicago, and L. S. Ayres & Company, in Indianapolis. Shortly before the holidays both these stores installed a complete electric delivery service.

L. S. Ayres & Company have installed six Waverley light delivery wagons and a one-ton furniture wagon of the same manufacture. These wagons were put in service December 1, 1912, and driven by drivers who were taken from the horse wagons. The drivers were given only a few days' instruction and then sent out with the wagons. The 7 vehicles replaced 12 single-horse wagons and 2 double-horse wagons. From the start they were able to handle the business of this great department store to the entire satisfaction of the customers.



Electric Delivery Wagons of Mandel Brothers.

The average miles per day per vehicle were 35 miles, and the maximum 67 miles. The average number of packages delivered per day per vehicle was 241, with a maximum of 462. The vehicles left the store at the usual time and returned earlier than would have been possible had the goods been delivered with the horse equipment. One electric on the suburban routes replaced two wagons, four horses and one driver.

The cost of operation figured as follows: $2 per day per vehicle for operating expense, including charging, washing, garaging and replacing of parts; $1.30 per day for fixed charges, including depreciation, interest, etc.; $2.50 per day for driver's wages; total daily charges per vehicle were $5.80.

Mandel Brothers' engineers looked into the matter of automobile delivery very carefully and spent several years investigating the best wagon for their use. The outcome was the purchase of ten Waverley specially designed 1,000-pound delivery wagons. These wagons are shown herewith; they have a body large enough to accommodate any requirements called for in the delivery system of a large department store. The service has been very satisfactory both in the long hauls and in the nearby service also.

Five of the wagons are equipped with batteries capable of giving 60 miles on a charge, and the other five are equipped with batteries large enough to give 75 to 100 miles per charge. All the deliveries are made by electric machines. The speed of these vehicles is 14 miles per hour.

All of these vehicles, except the Ayres furniture wagon, are of the shaft-drive type, with full elliptic springs, Timken roller bearings, full floating type of rear axle, irreversible steer and continuous torque controller.

Electric Power on the Farm.

The following extract from a letter addressed to the Red River Power Company, Grand Forks, N. D., shows the satisfaction experienced through the use of electric power on the farm by J. D. Bacon. He has one 20-horsepower motor.

"In reply to your question regarding electric power on the farm, will state that we would hardly know how to get along without it since becoming used to such a convenience. In threshing and ensilage cutting, we are so much better pleased with it than with gasoline or steam that it is hard to compare them, and besides the great convenience, the expense is considerably less than with either of the other powers."

CENTRAL-STATION INFLUENCE ON THE ELECTRIC-VEHICLE INDUSTRY.[1]

By Stephen G. Thompson.[2]

Probably no better example of the influence of the central-station on the electrical-vehicle industry exists than in those sections of New Jersey served by the Public Service lines. Two years ago this territory presented a virgin field for electric-vehicle exploitation. The manufacturers themselves were but casually attempting to market their product, and the public at large was not sufficiently informed of the merits of electric-vehicle operation to take kindly to its adoption. Aside from a few commercial vehicles operated by manufacturing plants and by New York business houses, but few of these machines were in use, and, with the exception of those power wagons owned by the Edison Storage Battery Company and allied interests, there were no large installations in the state. Pleasure vehicles had met with little favor, there being a total of but 80 machines—many of an ancient type and nearly all but frequently used.

An investigation of the electric-vehicle conditions in those cities which were leaders in the use of these machines, influenced the Public Service Electric Company to attempt their introduction in its territory, and for that purpose an automobile department was established, whose accomplishment in the introduction of vehicles is graphically represented by Fig. 2, which shows the increase in the number of vehicles since the inception of this department.

In the illustration, curve "D" represents the number of vehicles within the territory; curve "E" shows the total number consuming current from the Public Service lines; curve "F" shows the number of pleasure vehicles in use, and curve "G" shows the number of vehicles of the commercial type.

It will be observed that the increase in the number of pleasure vehicles is practically a straight-line rise. This is accounted for by the fact that the attitude of the Public Service Company

1 Paper presented at meeting of Electric Vehicle Association of America, New York City, December 17, 1912.

2 Public Service Electric Company, Newark, N. J.

immediately influenced the manufacturers of these machines to engage actively in marketing their product in this territory. The variations from the straight-line curve are attributable to the influence of the seasons.

The commercial-vehicle increase is shown to be of a slower growth during the early period of activity, while in the last few months is quite marked. This is a natural condition, as the development of power-wagon use necessarily requires a longer introductory period of education than that of the pleasure machines.

An analysis of the power-wagon conditions in this territory today discloses some rather astonishing facts regarding the statute of the electric commercial vehicle, and if these conditions may be accepted as an indication of the general trend throughout the country, we need have no fear for the future of the electric commercial-power-wagon industry.

At the present time we find a total of 731 commercial vehicles of all types employed within this territory. Of these, 191, or 26 per cent, are electrics. The balance are gasoline machines. As this 26 per cent in electric machines represents the product of but nine vehicle manufacturers, while the 74 per cent of gasoline machines were marketed by 158 makers, it would appear that the electric-vehicle manufacturers are certainly obtaining their full share of the total power-wagon business.

If we go further into the analysis of these figures, we discover that of the 540 gasoline machines in operation, 355 are low-grade cars whose selling price is in the neighborhood of $1,000. In this class are represented 60 vehicle makers, while the balance of 185 gasoline cars are the product of 98 different companies. In other words, over 50 per cent of the total number of high-grade power wagons employed are of the electric type. Let me impress this statement upon you more strongly. Nine electric-vehicle manufacturers, in competition with 98 gasoline makers, have marketed 50 per cent of the total number of machines of similar quality employed within the territory under discussion. Under the circumstances it would appear that the acceptance of the gasoline power wagon is the influence of numbers rather than of quality or of possible application.

Fig. 1, showing the increase in kilowatt-hour consumption and income, will appeal strongly to the central-station manager, as the data therein contained indicates just what the use of power wagons means to his department. In this illustration curve A, represents the average income rate per kilowatt-hour. Curve B, represents the income in dollars, and curve C represents the kilowatt-hour consumption.

If this plotting is compared with Fig. 2, it will be observed that the rapid increase in energy consumption follows a marked increase in the use of commercial vehicles, and points to the fact that the introduction of these machines is of far greater importance to the central station than is that of the pleasure vehicle.

The decrease in the average kilowatt-hour rate as shown on curve A is attributable to the fact that a majority of these commercial power wagons are in the larger installations and public garages, paying for their current at the wholesale power rates.

While these curves are plotted to December 1, it is interesting that the indications point to a continued rise throughout December because of the vehicles which have been sold, but are not yet delivered, and assurances of additional business from cars not now

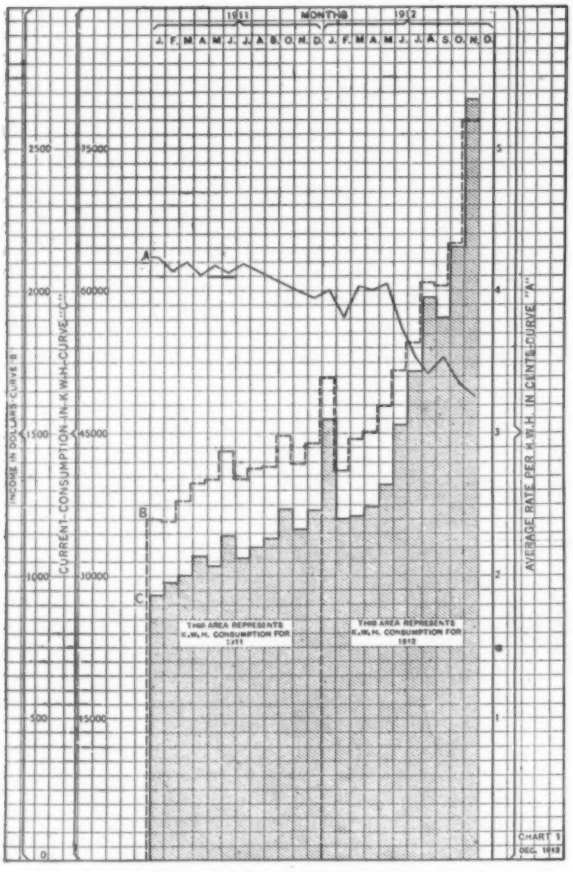

1911
MONTHS
1912
J F M A M J J A S O N D J F M A M J J A S O N D
INCOME IN DOLLARS (CURVE B)
CURRENT CONSUMPTION IN K.W.H. (CURVE C)
AVERAGE RATE PER K.W.H. IN CENTS (CURVE "A")
A
B
C
THIS AREA REPRESENTS K.W.H. CONSUMPTION FOR 1911
THIS AREA REPRESENTS K.W.H. CONSUMPTION FOR 1912
CHART 1
DEC. 1912

Fig. 1.—Kilowatt-Hour Consumption.

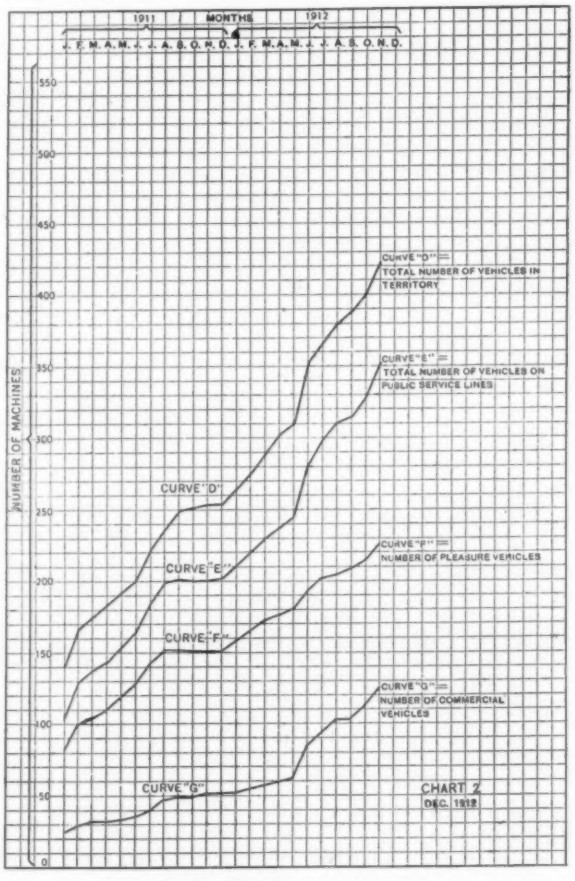

1911
MONTHS
1912
J F M A M J J A S O N D J F M A M J J A S O N D
NUMBER OF MACHINES
CURVE "D" = TOTAL NUMBER OF VEHICLES IN TERRITORY
CURVE "E" = TOTAL NUMBER OF VEHICLES ON PUBLIC SERVICE LINES
CURVE "F" = NUMBER OF PLEASURE VEHICLES
CURVE "G" = NUMBER OF COMMERCIAL VEHICLES
CURVE "D"
CURVE "E"
CURVE "F"
CURVE "G"
CHART 2
DEC. 1912

Fig. 2.—Numbers of Vehicles.

charged from the Public Service lines, now included in curve "D," Fig. 2. In these are included some 40 machines of the commercial type.

It is evident from the foregoing that the influence of the central station on the electric-vehicle industry is far-reaching in its results, and from reports of the vehicle manufacturers themselves, I have every reason to believe that educational campaigns in other sections have produced a marked increase in the number of electric commercial vehicles employed. I am strongly of the opinion that if central-station managers would make a market investigation of the local conditions, with a view to promoting the use of electric power wagons, they would find the field to be much larger than is generally believed; and, further, that the business can be secured with a very reasonable expenditure of money. This is borne out by the fact that in the operation of the automobile department of the Public Service Company the income has always exceeded the amount expended in promoting the use of electric machines, and we shall finish the year 1912 with a good profit. From our experience and our faith in the future of the electric vehicle, we feel that the ultimate wholesale introduction of power wagons can best be attained by continued effort along the lines which we have pursued during the past two years, rather than through extensive expenditures of a more or less speculative nature. Possibly we are wrong in our premises, but at any rate it is good business procedure.

Novel Window Display.

A novel window display attracted the attention of Louisville people recently, when the Kentucky Electric Company undertook a demonstration of electric incubators. The "Cypher" incubator was used, with the eggs in full view of the changing audience. An additional point of interest was secured because of the approach of 1913. This was an Alpha-Bet sign placed inside the incubator carrying the legend, "Hatching Out the Electric Year."

Electrical Construction

Notes on Switchboard Fires.

An electrical fire is at all times a most awkward occurrence to deal with, but it attains its greatest danger when it happens at a switchboard or the connections immediately adjacent to it. An arc on a cable, whether inside a station or outside, can usually be eventually stopped either by the operation of a fuse or circuit-breaker, or if these are not in a position to operate on the particular section involved, the cable will probably burn itself out; but when the trouble occurs on a switchboard at a generating or substation, it is a very difficult matter to get things right without the entire interruption of the supply. Fortunately, modern experience has to a large extent abolished the poor apologies for switchboards which formerly could be found, although even now improvements might be made with considerable advantage in many cases. Due regard has, however, been paid in the majority of cases to the abolition of inflammable materials such a woodwork about the switchboard, and the spacing of the terminals and conductors sufficiently far apart to prevent to a large extent the danger of arcing on the board. Even in these days, however, the ordinary spanner has been known to start an arc leading to an interruption of supply and a hospital case, and with the temptation to reduce as far as possible the overall dimensions of a switchboard, caused by the possibility of getting large amounts of power into a small amount of space so far as the generating plant is concerned, by the use of turbo-driven machines, there is still the chance that the clearances allowed are not sufficient in some instances. It is not, however, proposed to enter into this question in this note.

What should be emphasized, however, is the necessity for proper space, ventilation and insulation at the back of the board, especially where high voltages are adopted. With the advent of three-phase systems and high-tension work generally, the dangerous portion, that is to say, the high-potential gear, is usually placed behind a screen formed by the switchboard panels, on the front of which are the operator's handles, and under ordinary circumstances the operator need not go behind the board. At the back of the board there will often be found a narrow gangway traversed by cables, or worse still, by leads from dividing boxes to the switchboard, these leads, be it noted, being of inflammable material, and the temperature of this chamber is frequently pretty high. Moreover, in some cases the designer appears to lack a knowledge of mechanical design. For example, cases have been known where heavy cables have been led up an outside wall, passing into the switch chamber by means of ducts into which they were secured by wooden wedges or collars, the dividing boxes being placed, of course, inside the building. The weight and drag of the cable outside came directly on the wedges. Imagine what would happen if the lead sheathing tore or the paper insulation became unduly compressed, or the wooden wedges shrank owing to the heat of the switch chamber. It is for reasons such as these that measures against switchboard fires should be taken by providing adequate ventilation. The electric fan is not a luxury in such cases. Again, some switchboard designers appear to forget that even in the most tightly sealed chamber a certain amount of dust collects, and this dust has to be removed. The lot of the switchboard attendant who is told off on a high-tension job to go behind a cramped board with some form of feather duster or equally futile device, and attempt to get the dust off insulators carrying charged conductors, is not a happy one. Is it any wonder that in some instances such cleaning is more or less neglected? The result later on is a mysterious arc and a switchboard fire.

When the fire occurs it is, of course, useless to try the ordinary means of fire prevention; even fire brigades are beginning to understand this. Therefore, prevention is better than cure. Supposing, however, that a fire does occur, for example, owing to excessive heat in the switch chamber volatilizing the bitumen compound in the dividing box and allowing an arc to develop on the junction and spread along the cables, igniting anything inflammable. What is the best thing to be done? If the back of the switchboard is a constricted one, it is undoubtedly the best policy for the switchboard attendant to stay on the safest side of the switch-

board, and no one can blame him if he takes care of his own life. A means which has been suggested is to have on the switchboard a box or bucket full of fine dry sand. If this is thrown on the arc and happens to strike it, and happens to stick, the heat of the arc will melt it, forming a film of insulating matter tending to interrupt the arc circuit. This, however, is analogous to the old method of putting out an ordinary fire by throwing small buckets of water on it. In other words, it is very good if it is successful. If the man who invented Cerebos salt cellars would come forward with an idea for projecting a well directed stream of fine sand on to an arc he would probably confer a benefit upon the electrical industry, but at the present time such an invention still waits to make the fortune of the genleman who brings it to a practical issue.

A word may be said in this connection with regard to secondary fires caused in the first instance by electric arcs. The heat of the arc is very liable to volatilize the constituents of bitumen and rubber insulation in the vicinity, with the result that this may catch fire. For this reason, a plan has been adopted on some switchboards of protecting all connections, which consist simply of bare copper arranged on poreclain insulators, by means of asbestos braiding, and this is very often of some considerable value. Even this, however, does not eliminate all trouble, and cases have been known where fires started by an electric arc have worked along the insulation of the cable consuming it, with the ultimate result that the fire has reached other portions of the structure. For this reason, the advantage of absolutely fireproof construction in the vicinity of the switchboard is obvious.

Another fact which tends towards spreading of a fire, should it be started by an electric arc, is the use of oil switches. These are undoubtedly of the utmost value in ordinary switching operations, and are now almost universally used for high-tension work. It is easily seen, however, that should the contents of such oil tanks catch fire there is every probability that it would be a most difficult matter to cope with the flames so produced. It is even more difficult when such switches are placed in a tunnel or chamber having a strong natural draft, as the rush of air caused by the fire is apt to fan the flames, and to make the trouble more difficult to deal with. For this reason the writer suggests that the type of switchboard which depends on natural draft for its ventilation at the back, and is closed at the ends by open-work grilles of expanded metal, should be modified by placing sheet-iron doors in place of the grilles, and using an electric fan to blow air through the chamber, which fan can be shut down if a fire develops inside, thus rendering the air stagnant, and assisting to quench the flames of a secondary fire.

A very good method which has been adopted on some switchboards is to inclose the incoming cables, and so far as possible, their connections even after leaving the dividing box, in a sheet-iron trough or tray, which is then filled up with sand and a cover put on. This casing is then bound over with suitable clips, and the whole arrangement made fairly air-tight. The advantage of this is that should an arc develop, either in the cable, dividing box, or the leads, it will immediately melt some of the sand in its immediate vicinity, and this sand will form an insulating flux which will spread over the part affected by the arc, and tend to interrupt the circuit, thus quenching the arc. The disadvantage of this arrangement is that should it be necessary to inspect the cable or to make alterations, the casing is sometimes rather cumbersome to remove, and the sand is awkward to deal with, and such removal should not be attempted unless the portion of the switchboard in the vicinity is rendered dead. It will be seen, however, that the whole of the cable within the vicinity of the switchboard can be easily cased in in this way, and a means of protection against fire afforded at low cost, which goes far to eliminate fire risks. If, in addition to this, a wide earthed tray or trough filled with sand be placed all along the floor of the switchboard underneath the oil switches, it is evident that even should a switch tank catch fire and spill its contents, the burning oil will fall down into the sand and be soaked up by it, spreading only a short distance, and will burn itself out instead of allowing the stream of burning oil to spread itself over the floor of the switch chamber, and to drop off the switch gallery on to other apparatus.—*Electrical Review* (London).

Instruction in Handling Motors.

The operating department of the Pennsylvania Railroad Company are issuing orders to its employees to report in Philadelphia at regular intervals to receive instructions in the handling of electric motors. The taking of these instructions is optional with the men. The railroad company, however, prefers to give its men preference over outsiders in the new line of work.

Water Grant in Mexico.

The Electric Light & Power Company of Pachuca, state of Hidalgo, Mexico, has contracted with the government to use the waters of the Tepeji, Tlautla and San Luis de las Peras Rivers, in the states of Hidalgo and Mexico.

CIRCUITS FOR ELEVATOR SIGNALING.—I.

Standard System Used in Department Stores.

The importance of proper design and installation in signal circuits for electric elevators is something which is not so well appreciated as it deserves to be. The real efficiency of the elevator is measured largely in terms of the saving in time which the use of it makes possible, whether the elevator be employed in transporting passengers from one floor to another or in hauling freight. In the case of passenger elevators this saving depends about as much upon the character of the signaling system as it does upon the maximum speed which the hoisting machinery can give the car. Without simple and precise methods of signaling, the

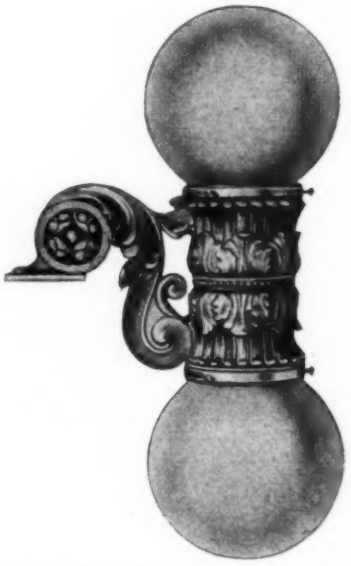


Fig. 1.—Modern Type of Signal Lantern.

operation of cars at the high speeds now so common in tall buildings would be impossible; and it is estimated that equipping a bank of three passenger elevators with the proper system of signals adds considerably more to the service than the addition of a fourth car.

The design of elevator signaling circuits is a matter in which a great deal of ingenuity has been exercised by engineers, in order to bring the art of signaling up to its present high degree of completeness, and the study of such circuits ought to prove interesting to any electrician, and helpful to many of them. The subject is one upon which practically nothing of any considerable value has been published heretofore, however.

The foregoing remarks are sufficient explanation of the reason for this se-

ries of papers. These articles will undertake to cover in a simple, practical way the signaling systems employed in various classes of buildings. Except the signals generally employed in ordinary freight elevators, which are nothing more than a simple arrangement of bells and annunciators, the simplest signaling system is the one which has become standard for department-store service. The present paper will be confined to a description of signals for passenger cars in stores of this kind, and the description will apply especially to apparatus designed by the Elevator Supply & Repair Company, of Chicago and New York, and installed by this company in the large department stores.

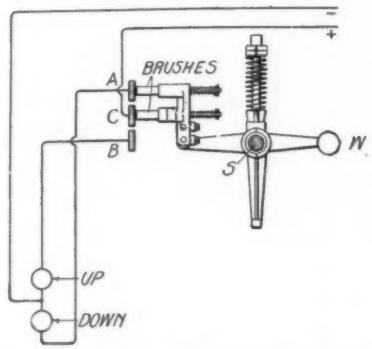


Fig. 2.—End View of Commutator, Threaded Shaft and Brush Holder.

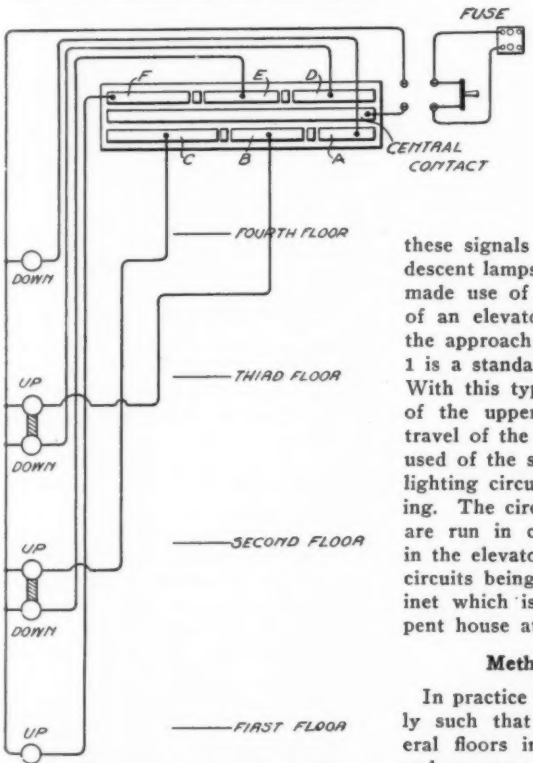


Fig. 3.—Diagram of Circuits for Four-Floor Building.

It is the practice in department stores to have each operator of a passenger elevator stop his car at every floor, both in going up and in coming down. Hence it is not necessary to equip the cars with signals for calling the operator's attention to floors where passengers are waiting, as is the case in office buildings and in other buildings of a similar character. It is necessary, though, to install automatic signals at the door of each elevator shaft on every floor which will give passengers waiting on any floor due notice of the approach of a car, and, at the same time, indicate the direction it is going. As is well known, these signals usually consist of incandescent lamps, one color of lamp being made use of to indicate the approach of an elevator going up and another the approach of a descending car. Fig. 1 is a standard type of signal lantern. With this type of lantern the lighting of the upper lamp indicates upward travel of the car. Standard lamps are used of the same voltage as the main lighting circuits throughout the building. The circuits for the signal lamps are run in conduit, which is installed in the elevator shaft, the fuses for the circuits being located in a cutout cabinet which is generally placed in the pent house at the top of the building.

Method of Operation.

In practice the arrangement is usually such that lamps are lighted several floors in advance of car travel, and as soon as a car passes a given floor the signal light on that floor is extinguished. How this automatic control is effected may be seen from a study of Figs. 2 and 3.

The parts marked *Central Contact, A, D, F, B, C,* etc., in Fig. 3, are parts of what may be called a commutator for controlling the current to the signal lamps. These parts are all fastened on one side of a piece of slate three-quarters of an inch thick, about four inches wide and of a length depending on the number of floors to be served. On the back of the slate are the terminal connections for the wires. The central piece, called the feed strip, is a continuous strip of brass extending from one end of the slate to the other, and the strips on either side of this are cut into pieces whose lengths are determined by the distances between floors. The so-called "slate" is arranged with the flat surface in a vertical plane and with its length horizontal. Installed along the length of the slate, and just in front of the strips of brass which make up the commutator there is a long threaded shaft which revolves in bearings in the end brackets supporting the slate. On the threaded shaft there is located a traveling nut which carries a brush holder and brushes, and which moves from one end of the commutator to the other, back and forth, as the elevator travels up and down between the terminal floors. Since it is driven, through sprockets and a chain belt, by the shaft which carries the overhead cable sheaves, the direction of rotation of this screw, and consequently the direction of travel of the brushes along the commutator, depends upon whether the elevator is moving upward or downward. The two brushes that the traveling brush holder carries are connected together electrically and are so arranged that one brush always rests on the central feed strip of the commutator and the other on either the upper or the lower row of metal floor segments, depending upon the direction the elevator is moving. The friction between the traveling nut and the screw, which can be varied at will, holds the brushes against the commutator, and so the reversal of the direction of rotation of the screw causes the brushes to shift from the central and one outer strip of the commutator to the central and the other outer strip. For example, as the elevator reaches

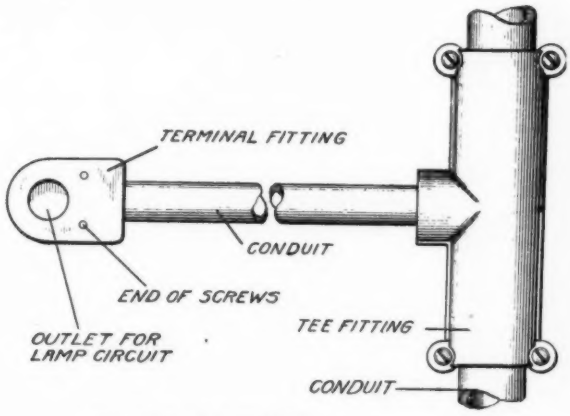


Fig. 4.—Conduit Fittings.

the top of the shaft in which it runs, the brushes make electrical contact between the central strip and the segment *A*, and the "Down" lamp on the top floor is lighted; then as the car starts down again the brushes are shifted so as to establish a circuit between the central feed strip and the segment *D* of the commutator, and the brushes begin to travel to the left. It is understood, of course, that the brushes move the length of the commutator, to the left or to the right, as the case may be, while the car is completing the distance between the top and the bottom or between the bottom and the top of the shaft in which it travels.

The foregoing makes it a very simple matter to trace the current through the signal lamps. In Fig. 3 circuits are drawn for a building having only four floors, since to show a greater number of floors would unnecessarily complicate the figure. As has just been stated, when the car is at the top floor the brushes make connection between the middle or feed section of the commutator and the segment *A*. Assuming direct-current supply and the positive wire to be connected to the feed strip, the current flows across the gap between the two parts of the commutator mentioned, and then through the lamp on the top floor. When the car starts the shifting of the brushes already spoken of takes place, and the current flows to *D* and through the "Down" lamp on the next floor below; and similarly until the lowest lamp in the series has been lighted. When the car leaves the first floor on the return trip the brushes are shifted, and the "Up" lamps are lighted one after another in a way that has already been made clear.

Fig. 2 is a rough cross-sectional view of the brass segments of the commutator, the threaded shaft (*S*) and the brush holder which travels on it, this sketch being intended to indicate the general arrangement of these parts rather than to be an exact cross-section of them. As the sketch is drawn, the "Down" lamp on a floor is burning. The path of the current is from *C* to *A*, through the lamp, and back to the opposite side of the line. A reversal of the direction of travel of the car would shift the brush connection from *C-A* to *C-B* and cause the "Up" lamp to light up.

It is interesting to note in passing that the moving-pointer index frequently installed on one of the floors of a department store to indicate the position of the car at any time is operated from the threaded shaft which carries the commutator brush holder. The operation is by means of a chain belt and steel tape.

Installation of Conductors.

Reference has already been made to the method of installing signal circuits in elevator shafts. Perhaps the most difficult part of such work is encountered in bringing out the wires to the lamps at the necessary points along the vertical run of conduit in the elevator shaft, and this job presents no unusual difficulties if the proper fittings are made use of. Fittings used for this purpose by the Elevator Supply and Repair Company are illustrated in Fig. 4. At an outlet point the vertical pipe is interrupted within the long sleeve which constitutes the larger part of the tee fitting. This sleeve is split along its length, so that the plane of separation passes through the center of the short tee provided for the branch pipe to carry wires to the lamps. The inner surface of the sleeve and that of the piece for receiving the branch pipe also is slightly elliptical in form, so that the fitting may be tightened down securely on the ends of the conduits inserted in it by means of the four screws which hold the halves of the sleeves together.

The opening for the conduit in the terminal fitting of the branch pipe is also elliptical, and hence good contact between this and the conduit from the outlet box is made by tightening the two screws which pass through the box from the back of it to the front. In Fig. 4 the front of the outlet box is shown. When the box has been installed, the front of it fits closely against the wall of the elevator shaft. Where the construction of the building is such as to make it necessary, support for the signal lantern may be obtained by means of a short pipe extending through the wall of the shaft, the pipe being secured in the outlet box with a locknut and a bushing.

Elevator signaling circuits usually consist of No. 14 copper wires, and the same grade of insulating covering is required as must be employed on conductors for other classes of conduit work. The conduit riser in the shaft is of the size determined by the number of floors to be served. In very tall buildings it may be necessary to use a pipe as large as 2.5 inches in diameter. The lateral pipes generally consist of standard half-inch or three-quarter-inch conduit.

Arizona Metal Production in 1912.

Arizona experienced in 1912 an exceptionally good year in mining, especially in the mining of copper ore, and the preliminary total value of all metals is estimated at more than $65,000,000, an increase of more than $20,000,000, or 49 per cent, above the production for 1911. Of this total value, the copper output represented over $58,000,000.

Significant Suggestions for the Electrical Contractor.

There has been unstinted advice to electrical contractors within the last year or two as to how to bring about improvements in the contracting business, but it has been contended sometimes that many of those who have assumed the role of adviser have seemed to know no more about the needs of the business than the people whom they have essayed to advise. However this may be as a general contention, it is certainly true that contributors in a recent issue of the *Electrical Contractor* (London), have given the difficulties with which the contractor has to contend some rather careful consideration. The substance of the remarks found in this particular issue is well worth repeating.

It is pointed out that not many years ago the master gasfitter, in England, was a prosperous craftsman, but that now he has practically ceased to exist. When electric light became a competitor of gas, manufacturers and distributors of gas saw that energetic steps must be taken immediately to encourage the use of gas for cooking, heating, and motive power, and they rushed into the gasfitting business, hiring out gas fires and cookers, and fixing them at rates which no private trader could afford to offer. It was a wise policy so far as the gas companies were concerned, but it proved disastrous to the master gasfitter, who was simply pushed to the wall. He was unable to put up any effective resistance, through lack of co-operative action and fighting ability.

It is asserted that history seems about to repeat itself in the case of the electrical industry, and that if the contractor does not bestir himself and show central stations and other electric supply undertakings that he can do good work at competitive prices, and that he is willing to organize his trade and do his share towards energetically spreading the gospel of electrification, he will soon cease to count as a factor in the electrical industry.

There is an expression of gratification that the Electrical Contractors' Association in England is ready frankly to acknowledge the position, and to give and ask for advice as to the best way in which its members may not only be saved from extinction, but may place the contracting industry upon a sound and progressive basis. An appeal is therefore made to members and non-members alike to combine their forces and to present a united front against the encroachment of municipal trading. It is wisely acknowledged, however, that opposition must not be the only func-

tion of the contractor, but that a constructive policy must be undertaken and the trade organized on such progressive lines that other interests will recognize the commercial worth of the contractor as a body, and will leave him in undisputed possession of the industrial sphere he has made his own.

An interesting suggestion is that the affairs of the Electrical Contractors' Association might be placed in the hands of a capable and experienced business manager, who would be well paid to organize a persistent propagandist campaign, carry out the constructive policy of the Association, and arrange for the establishment of co-operative showrooms. He would make it his business to find out local requirements and to foster good relations between contractors and the supply undertakings in whose area they operate. The idea is worth serious consideration by the members, but the man selected for the position would need to have exceptional ability as a commercial organizer, and if such a man were found, his services should be paid for on a very liberal scale.

A second article in the same number of the *Electrical Contractor* deals with the important question of shop window displays and the value of concentrating the attention of passers-by upon one class of electrical apparatus at a time. Instead of the window space being crowded with a multitude of fittings, radiators, lamps, fans, etc., it should be devoted successively to displays of these articles by themselves, the object being to concentrate instead of to dissipate attention, and to persuade potential customers to enter the shop. In the summer a fan display would be appropriate, while at the beginning of the lighting season lamps and fittings might be shown exclusively, other window displays being of electric irons, cooking apparatus, radiators, and so forth. The contractor must prove that he can handle sales and run an attractive showroom, not only as well as, but better than, the central station man, if he is to check the advance of municipal electrical trading.

Electric signs is the subject of another article. Contractors, it is argued, cannot hope to interest other traders in the sign question if they themselves do not employ illuminated or other electric signs over their own premises. There is plenty of business to be done in signs, but the contractor who wishes to develop this department must first show his own faith in them. If his shop be in a main thoroughfare he can increase his business possibilities by keeping the window illuminated after closing hours. This does not necessitate personal attendance, since a time switch will switch the lamps on and off at any desired hour. The idea of after-closing-time lighting will also be encouraged among other tradesmen in the locality.

The necessity for co-operative newspaper advertising is emphasized in a separate article. An "electrical page" should be inserted in the joint interests of the contractors and the power-supply undertaking in one district, and this should appear in the leading local newspapers at regular intervals, and not spasmodically. One such page might be devoted exclusively to electric lighting, a second to heating, and a third to cooking, others dealing with electric ironing, vacuum cleaning, and so on. Naturally the particular item advertised on the "electrical page" would form the subject of simultaneous special window and showroom displays by the contractors concerned.

Size of Conductors.

Speaking on the subject of electric wiring before the Association of Engineers-in-Charge (London) not long ago, Frank Broadbent called attention to some unusually interesting relations concerning voltage drop and temperature rise in electrical conductors. The substance of this portion of his remarks follows.

At one time the only recognized rule bearing upon the size of conductors was that which says that the density of current should not exceed 1,000 amperes per square inch of section. This first appeared in the Wiring Rules of the Phoenix Fire Office, drawn up in 1882, and is still retained in the rules of the company. With the exception of the Phoenix Fire Office, all the leading insurance companies have now adopted the Institution Rules, in which the current varies with the section, and is determined by the temperature rise of the conductor. The permissible density is such as to limit the temperature rise of rubber-covered conductors to 20 degrees Fahrenheit above the surrounding air, and, for paper-covered cables the temperature rise is limited to 50 degrees Fahrenheit. Under these conditions, small rubber-covered conductors, carrying anything up to about 17 amperes, may be run at a density of 4,000 amperes per square inch, and 50 amperes may be carried at a density of 2,000 amperes per square inch, while in large conductors carrying 600 amperes, the current density must not exceed 600 amperes per square inch. This falling density is, of course, due to the fact that the radiating surface of a conductor is proportional to its diameter whereas the sectional area is proportional to the square of the diameter; hence, at the same current density, a large conductor would become warmer than a smaller one.

The question of the temperature rise in small conductors is a factor which, as a rule, is secondary to the question of pressure drop. Unless the length of conductor is very short, it is not possible to use such high densities as the temperature limit would generally allow.

When lower voltages were used than those now obtaining the pressure drop was a more important consideration than it is to-day, when supply pressures for lighting are quite commonly 200 volts and over, and those misguided people who, on the advent of the metal filament lamp, put in auto-transformers to reduce their lighting pressure from 200 to 25 volts, soon discovered that a variation of two or three volts had far more effect on the light given by the lamps on the lower than they had noticed on the higher pressure. What we have to consider in designing an installation is the percentage rather than the actual variation in volts. Hence, while a variation of 4 volts up or down from the normal represents only a rise or fall of 2 per cent on a 200-volt circuit, and would be quite permissible, it represents 16 per cent on a 25-volt circuit. Of course, the actual variation between the upper and lower limits is double the percentage given; but it is usual to consider the voltage variation as the percentage rise and fall above or below the normal pressure of the circuit.

The percentage variation on the candle-power of carbon filament lamps is much greater than the percentage voltage variation; for example, a carbon lamp rated at 16 candle-power on a 100-volt circuit will vary to the extent of about 1 candle-power per volt for moderate changes of voltage from the normal,—that is to say, 1 per cent variation of voltage produces about 6 per cent variation in light. In metal-filament lamps the ratio is about 4 to 1. This shows how very important it is to consider the drop of pressure on the conductors as well as the current density, and it is not advisable to allow more than 2 per cent to 3 per cent drop between the main switchboard and the lamps. The drop is generally divided about equally between the mains and the branches,—that is to say, half the full drop is allowed up to the distribution boxes, and half from the boxes to the lamps. If any distinction is made, rather more drop should be allowed on the branches than on the mains, as this will produce a smaller voltage variation on the lamps.

J. P. Kerns.

While the electrical contractor need not necessarily be an expert electrician always, an intimate knowledge of the details of electrical construction is, in nearly every case, a most valuable asset in the management of the contracting business. Since it gives him practical knowledge as to the amount of time needed for various tasks in construction, the possession of this knowledge may be of immense value to him in estimating the cost of prospective contracts. Moreover, it insures for him a better standing in the estimation of his employees, and is of value in various other ways. Among the successful contractors who are in the class of the practical electrician is J. P. Kerns, of Chicago, and he has found that the foregoing statements have been emminently true in his own experience as a contractor.

Mr. Kerns has been continuously engaged in electrical work along one line or another ever since he began to earn a livelihood for himself. Born in Illinois, and not far from Chicago, he came to this city as a young man and secured a place as a lineman for the old Chicago Edison Electric Company. For some time he was one of this company's electricians; at later periods was in the employ of the Chicago Telephone Company and of the Western Electric Company. He also did work for the Commonwealth Edison Company after the Chicago Electric Company and other smaller companies had been merged into this organization. His experience in electrical construction included work with Henry Newgard & Company and one or two other electrical contractors now prominent in Chicago.

Mr. Kerns started in for himself as an electrical contractor some six years ago and soon succeeded in building up a prosperous business. His office is at 3741 Ogden Avenue, Chicago, in which neighborhood his headquarters have always been. While he is prepared to take care of any line of electrical construction, he has found it best to specialize, in a measure, in the wiring of apartment houses and flat buildings. He says that he has done so much work of this character and has managed to keep good men on his payroll so long that his employees can often do much of such work as the cutting and bending of conduit for construction of the class just mentioned in the shop, without having gone to the building at all or having paid any great amount of attention to the architect's plans. It is a principle of his never to undertake any contract which he is not sure of being able to complete with satisfaction to his patron and with profit to himself.

Mr. Kerns is one of the original exponents of the doctrine of co-operation among electrical contractors, and he has shown his faith in co-operation by his own practice. He is a member of the National Electrical Contractors' Association and of the Contractors' Association of the state of Illinois, and he has always taken a lively interest in the affairs of these two bodies. He was one of the early members of the Faraday Electrical Association of Chicago, and a year ago the other members of that organization showed their appreciation of his interest in its welfare and his ability as a leader by making him the president, which position he now holds. Under his leadership the Association has grown and prospered steadily.

He is a fine type of the electrical contractor who knows the construction business thoroughly and whose ideas as to business policy are well thought out and safe to follow.

J. P. Kerns,
President Faraday Electrical Association, Chicago.

Among the Contractors.

It is stated that the Wilson-Maltman Electric Company, Baltimore, Md., has been awarded the contract for installing the electric wiring in the new department store for Stewart & Company. The new building is to be seven stories in height, and the contract will be one of some consequence.

Daubert & Shrecker, prominent electrical contractors of Louisville, Ky., have commenced the work of overhauling an extensive iron-conduit system of wiring in the new home of the Commonwealth Life Insurance Company at Fifth Avenue and Main Street in that city. This building was formerly occupied by the old Fidelity Trust Company, and is said to be one of the best lighted for general office use in the city. A handsome electric sign, unusual because of its position in the wholesale business district, has been placed over the office entrance.

The Nashville Machine Company, Nashville, Tenn., of which James Shingleton is the superintendent of the electrical department, has closed contracts for wiring the new Davitt apartment building and the Central Cigar Store building, both in Nashville. The company has also just completed the installation of an electrically driven "scratch-back," a device which loads a freight car and shifts the load from one end of the car to the other. This work was done for the Blue Grass Phosphate Company, of Mount Pleasant, Tenn.

Despite the presence of what might be termed bad weather for builders in general, the Home Electric Company, of Louisville, Ky., is engaged busily with contracts aggregating more than $2,000. A conduit wiring system for about 500 tungsten lamps was installed by the Home men in the big new American 5-and-10-cent store in Louisville, said to be one of the biggest and finest establishments of its kind in the country. The job cost $1,000. The Home company is now wiring the trio of new stores owned by the Hagan estate on Fourth avenue at a cost of about $600. A third contract is being handled in the dry-goods store of Blum Brothers.

The Kolker Electric Company, of Evansville, Ind., has just finished the electrical work in the Junior High School building in that city. This work included the installation of generators, switchboard and fixtures, and was done under the supervision of Robert Jordan, the manager of the company. Mr. Jordan reports that prospects for business during the coming year are good.

Rewiring the extensive plant of the Kentucky Tobacco Products Company, of Louisville, Ky., for tungsten lamps, is one of the important jobs of the Bland Electric Company in the Gateway City at present. The factory, producing an insecticide from tobacco stems, is to be lighted with more than 600 tungsten lamps. The Bland Electric Company is also installing conduits for more than 1,000 tungstens to be employed in the new store of the Boston Shoe Company in Louisville, about 7,000 feet of conduit being used. A notable Bland contract in hand at present is that for installing wiring throughout the handsome residence of W. E. Caldwell. Although the dwelling contains magnificent hardwood floors throughout, not a strip of parquetry is being injured by the work of the electricians.

National Association of Electrical Inspectors.

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Secretary's Message.

The Secretary regrets the nonappearance of our matter in the January 4 issue; he can only plead the fact that only four of the Executive Committee had sent in their replies early enough for use in that number. However, the intervention of Christmas holidays may have had something to do with that, as may also the usual overloading of the mails.

The Secretary desires to call the attention of a considerable number of members to the fact that current bills due are still unpaid. The Assocaition meets in New York in March and the Secretary earnestly requests the delinquent members to pay up promptly, as he needs the money before that time very badly.

In regard to the questions here presented there is no comment to be made beyond that of the answers as printed.

The Secretary requests members to send him promptly their ideas as to the propriety of making the fine print note to Rule 26*u* mandatory. This change has been suggested. *Please let him have your ideas upon it, and at once.*

Accessibility of Meter Fuses.

Question 211. One of our companies is installing three-wire meters on lines taken from risers, without the interposition of any other cutout than that sealed up in the meter case. This renders it impossible to make inspection (owing to the impropriety of breaking the meter seal) and also results in carrying the neutral straight through unfused. Is this difficulty being experienced elsewhere, and how is it being met?

Answer 1 (F). The type of meter mentioned is not being used in this jurisdiction.

Answer 2 (P). We are preparing to insist upon the right to break meter seals for the purpose of making inspection of fuses. This will probably result in the placing of a sealed cutout in series with the sealed meter, and as we already have an arrangement under which our inspectors break cutout seals when they see fit and then notify the company to re-seal, we can control the fusing of the circuit, and the cutouts in the meter will become superfluous.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Answer 3 (E). I am without experience with the practice outlined in this question. As I understand it, however, the fuses are installed by the electric light company, in a sealed iron cabinet, the meter being in the same cabinet, for the protection of the meter. Such being the case I do not see any material harm, inasmuch as any injury to the meter would be contained in the metal case and no hazard would be introduced into the building. Should the meter be overfused and consequently be destroyed or injured, the loss being property of the electric lighting company, the company would naturally supervise the installation of fuses of the proper size.

Answer 4 (H). The difficulty indicated in this question has not arisen in this territory. If it should arise the work will promptly be condemned, as the entire practice and the aim of the Code is to protect meters and the construction behind them.

Answer 5 (B). In this city we have an understanding with company supplying current that our inspectors may, whenever they deem it necessary or advisable, break a seal for the purpose of making inspection of cutouts to ascertain whether they are properly or improperly fused. In any cases where this is done they are to report at once to the department office and company owning the seal in question is notified so that it may replace same.

Answer 6 (K). From this question we gather that the meters are sealed up in cabinets, and that the fuses are inclosed in these, since we are not familiar with watt-hour meters having fuses inside the case of the instruments themselves. Under the general rule that all apparatus and circuits require adequate fuse protection and that cutout must be reasonably accessible, we should insist that the proper cutout be installed outside the case of the meter. In our territory, however, we have not encountered the difficulty referred to in this question.

Answer 7 (O). The difficulty mentioned has not arisen in this territory, but should it arise it will be met by criticising any violations of the Code requirements. If the Code should require fuses on the branch circuit to the meter, we should probably not consider the fuses sealed up within the meter case, but would call for other fuses at the point where the branch is connected to the mains.

Answer 8 (N). The Code requires cutouts to be "readily accessible"—Rule 23*c*. Those indicated in this question are not so arranged and should be rejected, unless there is an understanding, as in this jurisdiction (municipal), that the inspector may break meter seals when necessary, promptly notifying the supply company of his action, giving his reason.

Protection for Five-Wire Services Having Separate Meters for Day and Night Loads.

Question 212. What are the proper requirements for main-line fuses and switch in the case shown? Two meters are connected in series with potential taps leading outside the building. These are controlled automatically by a switch on the pole which is operated by the street-lighting system, to give a low rate during the day. Bearing Rules 23a and 24a in mind, should the potential taps be considered as part of the service, and a five-pole switch and fuses (three 31 to 60 and two 1 to 30 holders) be installed; or would it be permissible to run the potential taps without inserting switch or fuses? There being no five-wire switch on the market, might one use a four-pole switch and fuses on the two outside wires and two potential taps, and use a single-pole switch on the neutral? It is undesirable to open the potential taps without the main switch and service wires, as then the meters would not record.

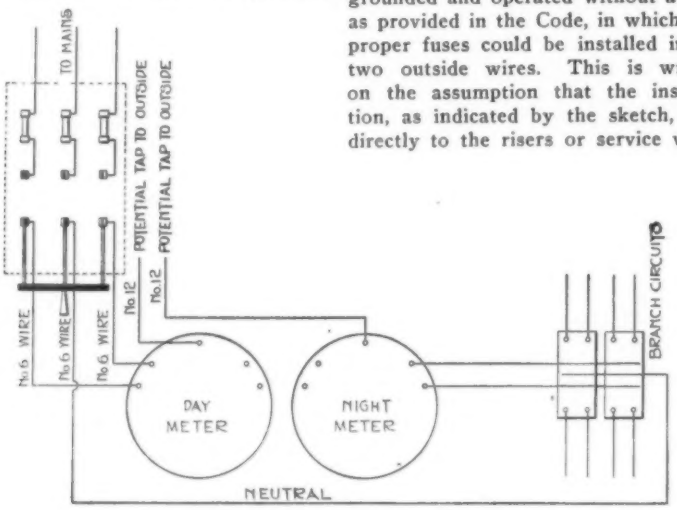


Fig. 1.—Diagram Illustrating Question 212.

Answer 1 (P). This is a special layout and should be met by special appliances. The fact that there is no five-wire switch on the market does not prevent the construction of one to meet this situation. The use of one four-wire switch and one single-pole switch introduces an unnecessary complication.

Answer 2 (F). In accordance with the intent of Rule 23*a* and 24*a* all five of the wires entering the building should be protected by properly proportioned fuses and controlled by a switch that will open each wire by one motion of the switch. As to the use of a single-pole switch, this is prohibited by Rule 24*c*.

Answer 3 (E). In installations similar to those indicated in this question I have not asked that the taps pass through a switch. There are, however, five-pole knife switches on the market, which are used in a number of places in my territory for five-wire services.

Answer 4 (B). We have no cases similar to the one referred to, but Rules 23*a* and 24*a* would require, in our judgment, that all of the wires should be protected by fuses and controlled by a service switch. This would necessitate a special type of switch, as we know of no five-pole switch on the market.

Answer 5 (H). There seems to be no reason for accepting an automatic switch on a pole in cases similar to that mentioned in this question. I see no reason why the neutral wire indicated in the sketch should not be grounded and operated without a fuse, as provided in the Code, in which case proper fuses could be installed in the two outside wires. This is written on the assumption that the installation, as indicated by the sketch, runs directly to the risers or service wires.

Answer 6 (K). Under the Code, fuses would surely be required in the potential taps, unless the automatic switch in the street-lighting circuits were of some approved type which would automatically open the circuit in case of excessive current in the potential tap. We see no objection to the combination of switches inquired about. See Rule 24*a*.

Answer 7 (O). The arrangement shown in diagram violates Rule 19*a*, since the potential taps effectually bridge over the fuse and switch in the neutral wire. Fuses should be inserted in the two potential wires and if an approved five-pole switch is not available we would suggest that an approved three-pole switch and a double-pole switch be mechanically connected so that it would be impossible to operate one without the other.

Answer 8 (N). I have never met with such an arrangement, but should require the company, if it were to use many of the devices, to provide a five-pole switch, and if there were but very few in use, would allow a three-pole and a two-pole combination. I should certainly require fusing of the potential leads. If they want to use such a device they must be willing to risk opening the potential leads or provide some special device which will meet the Laboratory requirements.

Service Switches.

Question 213. In practice the rule (24b) requiring gravity to open the knife switch sometimes conflicts with the dead-blade requirement. Under such conditions which requirement should be given the preference? Would a service switch arranged as in the figure meet all the Code requirements?

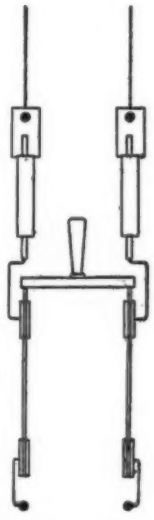


Fig. 2.—Arrangement of Switch and Fuses Referred to in Question 213. (Load Connected to Bottom of Switch.)

Answer 1 (O). A careful reading of Rule 24*b* will show that the second paragraph does not require the blades to be dead when the switch is open where this is not practicable; but the first paragraph requires without exception that single-throw knife switches be mounted so that gravity will not tend to close them. There is no conflict whatever in this matter. The diagram accompanying this question does not seem to indicate anything unusual or requiring comment.

Answer 2 (K). Yes, the fuses protect the switch and the blades are dead when the switch is open. In places where overhead distribution is employed extensively this sort of arrangement of the service switch is not at all unusual.

Answer 3 (H). We condemn the switch described in the first part of this question and require the use of one which will meet Code requirements. The construction indicated in the sketch would, I think, be approved.

Answer 4 (P). In this territory we give the preference to the gravity requirement. I fear that the clumsiness of the proposed switch, as shown by the sketch, would tend to offset any advantage that might be gained through its use.

Answer 5 (E). The circuit, as shown in the illustration, complies with the requirements of Rule 24*b*. The word "practicable," in the second paragraph of Section *b*, leaves the question open to the judgment of the installing contractor and inspector. Sometimes the full requirement may be observed by placing the switch in a horizontal position. The requirement that gravity will not tend to close a knife switch is a mandatory rule; there is no choice in the matter on the part of the inspector at all.

Answer 6 (F). Rule 24*b*, first paragraph, requires that single-throw knife switches be so located that gravity will not tend to close them. Rule 24*b*, second paragraph, requires that, where practicable, switches must be so wired that blades will be dead when switch is open. As it is practical to install switches in accordance with the above sections of Rule 24, service switches should always be so installed. The switch connections shown in attached sketch comply with the above and should be approved.

Answer 7 (N). The requirement that gravity shall not tend to close the switch is mandatory and must be followed. The only objection to the type shown (which may have either cartridge or plug fuses) is that when closing the switch the hand is unpleasantly near the fuses in case of a short-circuit, and I, consequently, do not allow such an arrangement as this in my territory.

Answer 8 (B). Rule 24*b* requires that single-throw knife switches must be so placed that gravity will not tend to close them. It does not insist that in all cases blades must be dead when switch is open, as it plainly states: "When practicable, switches must be so wired that blades will be dead when switch is open." This permits of the blades being alive when it is impracticable to wire the switches so that they will be otherwise.

Public Service Commissions

CALIFORNIA.

A decision has been rendered by the Railroad Commission denying the application of the Roseville Home Telephone Company, of Roseville, Placer County, to raise the rental charge on farmers' lines from 25 cents to 50 cents per month.

A decision was rendered granting permission to the Southwestern Home Telephone Company, of Redlands, to advance the monthly charge for telephone service from San Jacinto to Winchester, Riverside County, from $1.00 to $1.50 per month.

A decision was rendered denying the application of the Eel River & Southern Telephone Company, of Ferndale, Humboldt County, to establish a new schedule of rates.

A decision was rendered granting the application of W. H. Moffett & Son, of Lemon Cove, to increase the rate on its Lemon Cove telephone lines to 50 cents per month.

A decision was rendered denying the application of the Raymond Telephone Company, of Raymond, Madera County, to increase rates between Raymond and The Pines, *via* Coarse Gold and Fresno Flats. The Commission found the accounts of the company intermingled with those of a mercantile enterprise and directed that the telephone company segregate its accounts, so as to present a proper financial statement within the ensuing six months.

A decision was rendered in the case of the town of Willits versus the Willits Water & Power Company. The Commission upheld the contentions of the city of Willits in its complaint of discriminatory rates in favor of big consumers and against the general public. An order was issued establishing a general decrease of 12 per cent for individual domestic consumers and certain increases for large consumers.

A decision was rendered granting permission to E. W. Crosby, doing business under the name of the Reedley Telephone Company, to establish a farmers' line rate of $3.60 per year as against a former rate of $3.00. The company was denied authority to raise its exchange rates.

A decision was rendered granting permission to the City Electric Company to issue $833,000 of bonds to be used as collateral security for loans to be made by the corporation.

A decision was rendered granting the application for a transfer of a franchise from Russel Robison to the Russel-Robison Water & Electric Company, of Arroyo Grande, San Luis Obispo County.

A decision was rendered reducing the maximum lighting rates of the Northern California Power Company from 10 cents per kilowatt-hour to 7 cents in Colusa and Glenn Counties, from 9 cents to 7 cents in Shasta and Tehama Counties and from 8 cents to 7 cents in Butte County. The reductions became effective on January 10. The decision also calls for a material reduction in power rates throughout the northern part of the state.

The Commission decided to conduct a series of tests in the Induction Cases, in which the Pacific Telephone & Telegraph Company complained of serious interference with the operation of its telephone lines by induction from high-tension power lines in proximity to its wires.

NEW JERSEY.

The Board of Public Utility Commissioners has submitted its annual report to the Governor. Attention is called in the report to a number of the important cases which have been decided during the year and to the case now pending regarding the rates of the Delaware & Atlantic Telegraph & Telephone Company. Attention is called to the systems of uniform accounting for public utilities which have been adopted during the year. The subject of grade crossings and their removal receives considerable attention. It is suggested that the law be amended by repealing the present limit of $100,000 to the annual expenses of the Board, as that amount is not sufficient to

enable the Board to undertake all of the work which should properly be carried out by it. It also recommends an amendment requiring every public utility engaged directly or indirectly in any other business to keep in like manner and form the accounts of all such other business, the provisions of the act to apply with like force and effect to the accounts and records of such other business.

INDIANA.

In his inaugural address on January 13 Governor Ralson, of Indiana, recommended very strongly the passage of a public utilities law providing for a commission of three members. One of the first bills introduced into the Legislature, which convened on January 9, was a bill abolishing the present Railroad Commission and creating a Public Utilities Commission, to be composed of three members having terms of four years.

NEW YORK.

The Public Service Commission for the First District has presented its report for the year 1912 to the Legislature, although it is not yet prepared for distribution in printed form. This is the sixth annual report of the Commission. It shows that the total amount expended for subways to December 31, 1912, within the city of New York is $67,808,238. Three chapters of the report are devoted to the subject of rapid transit. The Commission recommends the amendment of the Transportation Corporations Act and the Greater New York charter in their provisions relating to stage-coach companies. Grade-crossing elimination and railroad accidents receive attention, and statistics are given covering the latter. Figures showing the total number of corporations under the jurisdiction of the Commission, their gross capitalization, the number of passengers carried by the transportation lines and the amount of gas and electricity produced are given. For the year 1911-12 the public in New York City paid for street-railway transportation $83,684,799. This is equivalent to about $16 per capita. For gas and electricity for a year the public paid $60,581,760—equal to about $12 per capita. The total number of passengers carried on street and electric railroads (including subways and elevated lines) was 1,680,914,025, an increase of 77,000,000 passengers over the preceding year.

The total capitalization, including capital stock and funded debts outstanding, of all companies subject to the jurisdiction of the Commission amounts to $1,104,993,683, of which $691,373,872 applies to street and electric railways and $136,968,751 to electric light and power companies.

The electricity generated amounted to 589,778,573 kilowatt-hours. During the year the Commission tested 651 electric meters.

The Public Service Commission, Second District, has closed the proceedings commenced against the Federal Telephone & Telegraph Company in relation to the furnishing of free service. On September 10 the Commission made an order requiring this company to show cause why it had not become liable to penalties prescribed by the Public Service Commissions law for the furnishing of free service to 88 stations at Mt. Morris, Batavia, Avon, Dansville, Geneseo, Bath and Warsaw. Since the service of the order by the Commission the company has been actively at work cutting out free service which had been installed prior to the time when telephone companies came under the jurisdiction of the Commission. The rechecking by inspectors of the Commission shows that all of the subscribers referred to have either been put upon a paying basis, disconnected, or otherwise satisfactorily accounted for.

The Commission has authorized Wallace W. Holmes and Gilbert M. Holmes to construct and operate an electric plant in the unincorporated village of Redwood, Jefferson County, for the furnishing of electricity in that village.

The Commission has received a notice from the New York & Vermont Telephone Company that it has conveyed its physical property and business to the Granville Telephone Company for the sum of $3,000. The New York & Vermont Home Telephone Company operates in the county of Washington and towns of Granville, N. Y., and Poultney, Vt.

WASHINGTON.

The Public Service Commission has presented its second annual report covering the period from January 1 to November 30, 1912, to the Governor. A letter of transmittal reviews the work of the Commission during the year and emphasizes the fact that the requirement of the law providing that the Commission shall ascertain the value of the property of every public utility in the state for taxation purposes could not be carried out on account of the press of other matters and the lack of a sufficient staff. Recommendations made for new legislation were given in our issue of December 14. The report includes the orders which have been issued during the year and a list of informal complaints and their disposition, opinions of the attorney general, a financial statement and the reports of the engineer, inspectors and scale expert.

OHIO.

The Public Service Commission has ordered the Middletown Gas & Electric Company to amend its schedule of rates for breakdown lighting, the charges hereafter to be as follows: a minimum charge of $3.00 per month per kilowatt demand; for energy up to 150 kilowatt-hours, 10 cents per kilowatt-hour; for the next 150 kilowatt-hours, 9 cents; the next 300 kilowatt-hours, 8 cents; excess, 7 cents per kilowatt-hour; with a discount of 10 per cent for prompt payment. The company was also ordered to make, upon written request of any customer, a redetermination of the maximum demand, without charge, not more than four times a year.

The Dayton, Covington & Piqua Traction Company has been authorized to issue five-per-cent first-mortgage bonds of the par value of $40,000, to be sold for not less than 90 per cent of the par value, the proceeds to be used for the payment of prior liens aggregating $7,100 upon the property, and for the payment of certain items of floating indebtedness.

INTERSTATE COMMERCE COMMISSION.

The Commission has issued in printed form its instructions to telephone companies providing for a uniform system of accounts, the new system becoming effective on January 1. Detailed instructions are given explanatory of the various accounts required in the order.

Panama High-Tension Line.

A committee consisting of Edward Schildhauer, F. Mears, W. H. Rose, C. F. Bleakley, W. H. Fenley, and W. R. McCann, has been appointed by the Isthmian Canal Commission for the following purposes:

(1) Review the plans for the proposed high-tension power transmission line across the Isthmus.

(2) Consider the various features of the telephone and telegraph cables, the possible disturbance to signal system, the probability of the future electrification of the Panama Railroad.

(3) Make recommendations relative to the best and most economical construction to be employed for all the different electrical conductors, all phases of the matter being taken into consideration including any protection to electrical lines, and to guard against any possible attempts to cut communication in time of war.

Telegraph School in Guatemala.

The National Electric Telegraph School has been established in Guatemala City with a corps of 13 instructors. The school is well attended and has arranged an excellent course of instruction.

Among the Supply Men

Meeting and Conference of Prize Salesmen of Western Electric Company.

The Western Electric Company held a meeting and conference of prize-winning salesmen at Hawthorne and Chicago, Ill., from January 6 to 11. This was in connection with the sixth, seventh and eighth contests for merit conducted by the company, and included the second, third and fourth quarters of 1912.

The meeting included an assembly at the Hotel La Salle on Monday morning, a trip to Hawthorne and introduction to the shop officials. The sales exhibition rooms were visited and prize badges presented. There was a talk by S. S. Holmes on "Inspection of Telephone Apparatus."

A dinner was held at the University Club at 6:30 p. m., and in the evening the bowling tournament at Mussey's was attended.

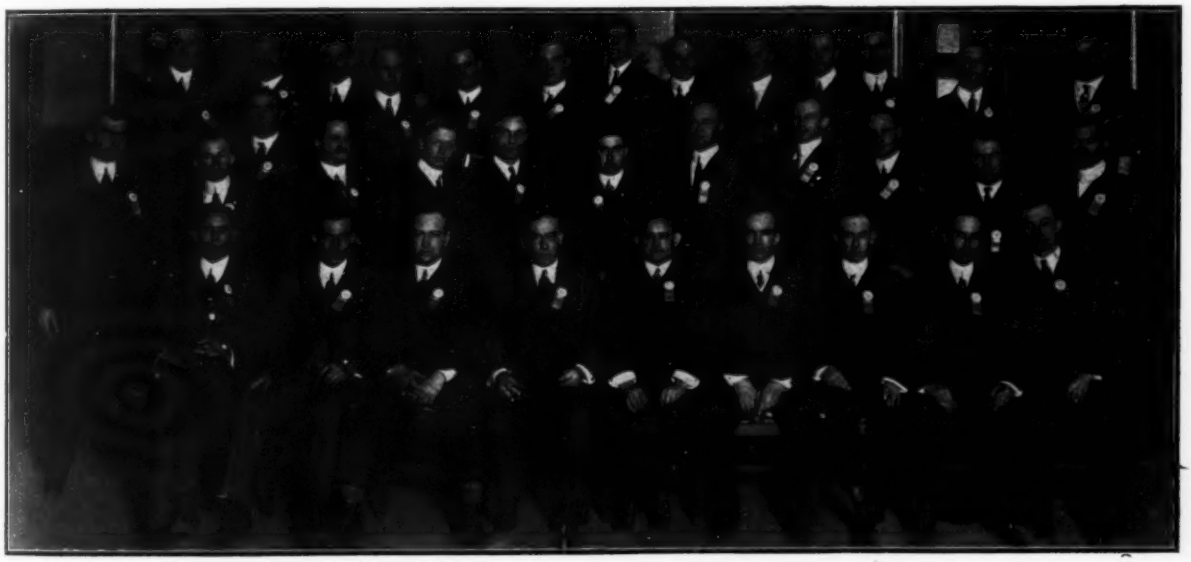
On Tuesday morning there was a talk by H. C. Quigley on "Inspection of Raw Material," and a talk by Mr. Skinkle on "What the Western Electric Company is Doing to Increase Efficiency in Manufacturing Methods." Tuesday evening the party attended the performance of the "Count of Luxembourg," at the Illinois Theater. On Wednesday morning there were talks by Mr. Hall and Mr. Brown on "Selling Points of Telephone Apparatus." On Wednesday evening there was a beefsteak dinner and smoker at Vogelsang's.

On Thursday morning there was a talk by Mr. King on "Power Apparatus and Supplies," and a talk by Mr. Howlett on "Power Apparatus." On Thursday afternoon there was a talk by Mr. Thomson on "Relation of Advertising to Sales," and a talk by H. N. Tolles on "The Science of Selling and Business Building." On Thursday evening the prize winners attended the Hawthorne men's club banquet at the Hotel La Salle. This was attended by 960 Western Electric men, and was one of the biggest banquets of its kind ever held in Chicago.

On Friday afternoon there were talks by Gerard Swope, O. D. Street and E. W. Rockafellow, of the general sales staff. The conference ended with a private banquet at the Hotel La Salle on Friday evening.

During each day there was an inspection of shops and lunch served at the Hawthorne Club. At luncheon there were addresses made and band concerts or some other form of entertainment.

The prize winners were C. K. Brackett, J. W. Pearce and I. B. Sanborn, New York; W. J. Schott and G. R. Rider, Kansas City; W. E. Flowers and C. O. Pinch, Atlanta; Mr. Lancaster and C. L. Schoen, Richmond; C. R. Baehr, Cleveland; A. N. Bannister and R. G. Call, Minneapolis; U. S. Arnold and C. A. Faubion, Dallas; R. Kauffman and W. C. Robinson, Pittsburgh; F. H. Barber, Salt Lake City; F. C. Jaeger and C. S. Horton, Philadelphia; C. W. Monk and H. E. Herrmann, Cincinnati; Mr. Crawford and C. Youngster, Denver; J. A. Wahlgren, Buffalo; L. E. Darrow, Los Angeles; N. E. Gould, Boston; F. Parrish, Seattle; T. C. McFarland and D. G. Cameron, St. Louis; F. D. Roseborough, Omaha; E. A. Crowson, San Francisco; F. H. Van Gorder, W. H. Thomas and A. C. Poggi, Chicago.



Conference of Prize Salesmen of Western Electric Company.

These salesmen were eligible for the Hawthorne trip. The others, winners in previous prize contests, and therefore not eligible for the Hawthorne trip, were: F. L. Smith, Buffalo; J. W. Alexander, Philadelphia; F. H. Sherman, Boston; C. B. Price, Pittsburgh; C. D. Cabaniss, Atlanta; G. H. Porter, Chicago; G. F. Bertke, Cincinnati; H. W. Hallett, Kansas City; W. B. Lewis, San Francisco; J. W. Alexander, Philadelphia; M. G. Clark and C. F. Howes, Boston; J. H. Pearson, Jr., Richmond; G. H. Lounsberry, Chi-

cago; G. F. Bertke, Cincinnati; H. W. Dye, Denver; W. B. Tavenner, Los Angeles; J. C. Enders, New York; J. W. Alexander, Philadelphia; F. H. Sherman, Boston; F. B. Vary, Atlanta; H. G. Carter, Cincinnati; F. D. Roseborough, Omaha; V. Garber, St. Louis; A. D. Barber, Kansas City; H. W. Dye, Denver; U. S. Arnold, Dallas; W. B. Lewis, San Francisco.

Among the executive officers present at the banquet were W. P. Sidley, vice-president and general counsel; Gerard Swope, general sales manager; F. V. Bennis, supervisor; O. D. Street, general telephone sales manager; E. W. Rockafellow, general supply sales manager; W. E. Leigh, foreign sales manager; J. H. Hellweg, acting general merchandise manager; J. W. Bancker, assistant works manager; F. L. Gilman, superintendent of telephone apparatus shops; J. W. Dietz, manager educational department; F. A. Ketcham, central district manager; H. L. Grant, sales manager, Chicago; S. S. Holmes, chief inspector, Hawthorne; J. W. Skinkle, engineer of methods; H. C. Quigley, material inspector, Hawthorne, and C. A. S. Howlett, special representative, General Electric Company.

The committee in charge of arrangements included H. R. King, chairman; P. L. Thomson, G. Brown and W. A. Schnedler.

The Union Electric Company, Pittsburgh, held a sales convention January 2, 3 and 4. W. C. Jones, formerly in charge of the city department, has been appointed sales manager, and will have as his assistant George A. Schardt, who has been acting sales manager for the past six months.

The Nunn Electric Company, Amarillo, Tex., announces that Lawrence Westbrook, formerly manager of the apparatus department of the Hobson Electric Company, Dallas, Tex., has taken a similar position with it and will devote most of his time to handling the big apparatus and supply business.

Julius Andrae & Sons Company, Milwaukee, Wis., has published a new telephone catalogue No. 34, which will be sent to operating companies upon request. A new bulletin illustrating and describing current-consuming devices, with price list, will be sent to dealers. Ask for catalogue No. 30.

The James Clark, Jr., Electric Company, of Louisville, Ky., has sold to the Louisville & Nashville Railroad Company an electric tractor to be used in operating a locomotive turn-table of the Louisville & Nashville in East St. Louis, Ill. The Kentucky Public Elevator Company, of Louisville, Ky., has purchased from the James Clark, Jr., Electric Company two motors, one 25-horsepower and the other 50-horsepower, for equipping an addition to the big grain elevators owned by the company.

The Johnson Electric Supply Company, Cincinnati, O., has been incorporated, taking over the Johnson-Kennedy Electric Company. The new concern is capitalized at $10,000, with William J. McCauley, A. Bartley Horton, W. M. Reinhart and others as incorporators.

Chicago Jovians Hold Pleasant Dinner.

The Chicago Jovians held a very interesting dinner in honor of Jupiter, Frank E. Watts, on the evening of Friday, January 10, at the Hotel Sherman. Covers were laid for 75. John F. Gilchrist, assistant to the president of the Commonwealth Edison Company, was the speaker of the evening. Addresses were also made by Ernest Freeman, president of the National Electrical Contractors' Association; Sam A. Hobson, Third Past-Jupiter; Ell C. Bennett, Tenth and Eleventh Mercury, and George C. Richards, Statesman for Illinois. The toastmaster was A. A. Gray, Statesman-at-Large.

Plans were outlined for the holding of a rejuvenation in Chicago about March 1, preliminary to a monster rejuvenation it is expected will be held in connection with the convention of the National Electric Light Association in June.

Wire Inspection Bureau of New York Active.

The Wire Inspection Bureau of New York, through its secretary, Hugh T. Wreaks, reports a continually increasing demand for special inspection and tests and general engineering work on railway signal, fire-alarm, and electric light installations from railways such as Missouri Pacific, Chicago, Milwaukee & St. Paul, Northern Pacific, Chicago & Western Indiana, Chicago & Great Western, Chicago, Indianapolis & Louisville, and Southern Railway; from municipalities, especially those operating under a commission form of government, and from fire marshal's officers of the various cities; also an increasing tendency on the part of the railroads for records and tests on railway signal, telephone dispatch, and telegraph circuits.

Wireless Station for Paraguay.

In the Paraguayan budget for 1913 an appropriation is to be included for the establishment of a central wireless telegraph station, and improvements will be made at the two interior stations now in operation.

BOOK REVIEWS.

"Questions and Answers on the National Electrical Code." By T. S. McLoughlin. New York: The McGraw-Hill Publishing Company. Imitation leather, 232 pages (4x6½). Supplied by the Electrical Review Publishing Company for $1.00.

The title of this book is an unusually complete indication of the character of its contents. The author advances few or no opinions of his own as to what is the best form of electrical instruction for any given case. As a rule, each question appears to have been suggested by the paragraph of the National Electrical Code containing the answer to it and for the most part every answer is a rather literal statement of the Code ruling in the matter in question. The questions are short and to the point. Moreover, they cover all parts of the Code quite thoroughly. In the case of nearly every answer the rule and section of the Code from which the answer comes are indicated.

It is especially fortunate that the questions and answers relating to any special sort of construction or to any particular fitting, are usually brought together in a distinct group, from the different parts of the Code. For example, in what is known as Division One of Section Six, data covering knob-and-tube work very thoroughly are grouped, while Division Two of the same section treats conduit and metal-molding construction; on pages 128-130 inclusive most of the Code requirements relating to sockets are brought out; pages 97 and 98 cover the subject of fuses rather fully; and so on. In addition to the tables found in the Code there are others in which the author has brought together matter which he found could be well arranged in tabular form. This feature should contribute materially to convenience in using the book. There are also the rules of the National Electric Light Association concerning resuscitation from electric shock, and six or eight pages of other miscellaneous matter. The volume contains practically nothing in the way of interpretation of National Code rules. As a key and index to the Code, however, it should prove of value to men concerned with electrical construction. It appears to be the first book of its kind published.

"Popular Mechanics Year Book for 1913." Chicago: Popular Mechanics. Paper covers, 1,854 pages (6½x9½ inches). Supplied by the Electrical Review Publishing Company for 50 cents.

The Popular Mechanics shop notes for 1913 contains 595 easy ways to do the hard things in every trade and calling. This book is a reprint of all the articles which have been published during 1912 in the "shop notes" department of *Popular Mechanics Magazine*. The articles are indexed carefully.

HIGH-SPEED TURBO-ALTERNATORS.

Monthly Meeting of American Institute of Electrical Engineers.

The 279th meeting of the American Institute of Electrical Engineers was held in the Engineering Societies Building, New York City, on the evening of Friday, January 10. President Ralph D. Mershon called the meeting to order, but turned the chair over to Henry G. Stott, chairman of the Power Station Committee, under whose auspices the meeting was held. The paper of the evening was by B. G. Lamme and was entitled "High-Speed Turbo-Alternators—Designs and Limitations." An abstract of the paper follows.

The paper discusses the design of turbo-alternators with reference to the limitations imposed by very high rotative speeds and large capacities. The principal difficulties in the design of the earlier machines were found in the permissible weight which could be carried by bearings, undue noise due to the open construction of the machines, and the troubles incident to the through-shaft construction of the rotor. The bearing problem was eliminated by securing more complete data, which showed that the possibilities in this feature had hardly been touched upon. The solution of the noise problem was largely one of enclosing the machine without interfering with the ventilation. In doing this, the noise problem was practically eliminated, but the greater problem of ventilation then developed. Peripheral speeds up to 24,000 feet per minute have been employed. Bolted-on rotor shafts have superseded through shafts for very high speeds, and both the radial-slot and the parallel-slot types of rotors have inherent advantages for machines of certain capacities. Ventilation is difficult on account of the large total loss which occurs in a limited space, requiring very large volumes of cooling air at very high velocities. Various ventilating systems are described, and the effects of temperature limitations upon the design are discussed. Temperatures actually obtained are liable to be materially higher than the usual methods of measurement will indicate. These temperatures are inherent to the conditions of design and cannot be avoided economically. Limitations in speed, strength of material, etc., force the designer to certain proportions which preclude larger dimensions, or lower inductions in the iron, or lower densities in the copper, or increased ventilation. Development apparently lies in the direction of insulations which will stand the higher temperatures which may be obtained. Insulating materials are considered with reference to their mechanical strength and resistance to heat. The use of mica in various forms has solved many difficulties due to high temperature and to static discharges, which have sometimes punctured the outer wrapping when the mica below was not injured. Experience has shown that, when properly applied, it can safely stand temperatures of at least 125 degrees centigrade. How much more has not yet been determined. The copper and iron losses are analyzed; the total losses are no greater than those of low-speed units of corresponding capacity. Protection against fire within the machine is most effectively provided by doors or valves, entirely cutting off the interior of the machine from the outside air. The regulation is sacrificed to some extent, in order to limit short-circuit current, by making the armature reactance as high as the design will permit. The whole design has been carried far beyond the most economical construction, from the generator standpoint alone. In fact, the whole machine is more or less a compromise between desirable conditions as a generator, and most economical conditions as part of a combined turbine and generator unit.

The discussion was opened by Henry G. Reist, who complimented the author upon the completeness of his treatment, which left little room for controversy. He thought the size of a two-pole machine with a through shaft could be increased if the shaft were flexible instead of solid, as the rotor could then run above the critical speed. Machines are running today built on this plan with a capacity up to 2,000 kilowatts and speeds of 3,600 revolutions per minute. He pointed out that mica insulation as used today is a composite material containing shellac and usually some paper. These other materials do not resist high temperatures like the mica, but will char and cause trouble. When some organic material is discovered which will stand a higher temperature, then it will be advisable to use higher temperatures, but until then the temperatures should be confined to 100 degrees centigrade. There is no great advantage in close inherent regulation, since the best that can be produced is not good enough and it is necessary to regulate externally anyhow.

R. B. Williamson pointed out that in turbogenerators the speeds are far above those suited to the most economical design, and this is responsible for most of the difficulties encountered from heating, ventilation, etc. A two-pole machine with a capacity of 12,000 kilowatts, 25 cycles, with a through shaft has recently been built and tested, and such a generator is entirely practicable at a speed of 1,500 revolutions per minute. Sixty-cycle machines for this speed have been built with through shafts up to 10,000 kilowatts. These machines operate above their critical speed. Peripheral speeds have been pushed higher than necessary and better results have been obtained by improving the ventilation, using smaller diameters and greater axial length. This reduces the windage loss and correspondingly increases efficiency. Air ducts in the rotor are of doubtful advantage. It is better to design the rotor so that heat can pass from the copper to the iron and thence to the outer surface where it is removed by the scrubbing action of the air. Dirt usually clogs the air ducts sooner or later, thus making a dead air space. Separate blowers are in some cases desirable for large units, but good efficiency can be obtained with turbo fans and little can be gained in efficiency from separate blowers. He favored the use of air filters and referred to one handling 40,000 cubic feet per minute. He had observed the perforation of outer layers of insulation in a 6,600-volt engine-type generator. He considered these perforations due to inequalities in potential gradient arising from the different specific inductive capacities of the different insulating materials.

Philip Torchio objected to the lengthening of machines to save expense in the bronze heads, on account of the value of space in the engine room. He considered outside blowers slightly preferable for ventilation. He spoke of the ozonizing action which causes deterioration in insulation and he thought the cables leading from the machine should have a lead sheath. He compared the effect on regulation of radial slots and parallel slots and showed a diagram to illustrate it. In a radial-slot machine with air gap of three inches the maximum current on short-circuit was 40 times the full-load current. With a parallel-slot machine having all conditions the same except that the air gap was 3.75 inches, the maximum current was 13 times the full-load current.

C. J. Fechheimer spoke of the limitations in rotor design. These are (1) stresses; (2) temperature; (3) cost; (4) regulation; (5) ability to maintain voltage. A good design is necessarily a good compromise between these five factors. Modifying any one will usually produce some change upon the remaining four. From the standpoint of safety, stresses are the most important and should be treated conservatively. Second only to this is temperature, for if the critical charring temperature is exceeded the machine will burn out. Moreover, iron will age when heated and cooled alternately, thus reducing efficiency and increasing the heating still more. A designer must also aim to use the principal parts in future machines of different design without too great modification in patterns and dies. He pointed out that with high air velocities the air losses were enormous, since they are proportional to the cube of the velocity.

W. L. R. Emmet pointed out that the value of the product of such machines is enormous in proportion to the cost and consequently we can afford to use only the best. Purchasers should not limit the manufacturers too closely, es-

pecially with unimportant details. He referred to the matter of securing better insulating materials, which would stand high voltage at high temperature. He did not think it was safe at present to go as high as 125 degrees centigrade, since the insulating materials are subject to a destructive distillation.

Paul M. Lincoln pointed out that two-thirds of Mr. Lamme's paper discussed ventilation, temperature and insulation, which emphasizes the importance of these subjects. He said that high velocities of the air caused the generation of heat, and windage losses are sometimes a large proportion of the total losses. Exaggeration of this element leads to poor results, because the stirring up of the air itself generates heat in the machine. He pointed out the difficulty of securing insulation with high conductivity, the heat resistance being 1,000 to 3,000 times that of copper.

P. Junkersfeld referred to the machine of the Commonwealth Edison Company, Chicago, in which the generated voltage is only one-half the busbar voltage, being stepped up through an autotransformer, which introduces the necessary reactance in the generator circuit. More recently, units of the same kilowatt capacity have been installed in which the generator voltage is the same as the busbar voltage. The latter was a 60-cycle machine in which the problem of securing sufficient reactance was difficult. He emphasized the need of smooth air passages. Air filters are expensive to build in fireproof form, and it is hence desirable to do without them if possible. In some large installations it pays, but in small stations he doubted if it would pay, and the designer should aim at smooth and straight air passages, which will not clog up with dirt. Temperature coils are a necessary adjunct to a machine, since they show when the air passages have become so clogged up as to require cleaning. Purchasers will not agree to high temperatures unless they are reasonably certain that the machines will be as reliable as the present ones. A slight difference in cost is not a serious thing with a very large machine, and higher temperatures should not be adopted if it reduces the factor of safety.

H. M. Hobart stated that air could be cleaned without fire risk by washing it. This has the additional advantage of imparting humidity and reducing the initial temperature. He favored a separate plant for providing air, especially as some large stations now require as much as 200,000 cubic feet of air per minute. He thought present conditions justified the use of higher temperatures with safety. Customers do not necessarily want a machine that will last 20 years, since in 10 years it may be obsolescent; consequently lower first costs and high efficiency are more important than a long life. Since insulation is now the limiting point in design it should be attacked with energy, and the resources of modern engineering will probably result in extending the limit with safety.

W. L. Waters compared the parallel-slot type of magnet with the radial-slot type. The former is simpler to manufacture and the insulation is subjected to less severe operating conditions but suffers more from the difficulty of obtaining suitable material in the required form and of determining the actual distribution of stresses. The radial-slot type has consequently come into prominence recently. He referred to the energy wasted in eddies and churning from forcing the air and referred to one generator which ran cooler when its inefficient blower absorbing 100 horsepower was shut down. In many turbogenerators now on the market the temperature of the air is increased 15 degrees in passing through the machine when running without load and excitation. He doubted the accuracy of local temperature measurements from resistance coils or thermo-couples.

Comfort A. Adams treated some of the points which had been raised in the paper quantitatively, such as the relation of copper and core losses in engine-driven and turbine machines.

A. B. Field spoke of the difficulties in getting large steel castings and forgings to meet rigid specifications, and this had forced rotor construction along new lines in recent years. Many more machines are running at critical speed than is generally believed, but he considered it advantageous to run below the critical speed, especially with four-pole machines as distinguished from two-pole machines.

B. G. Lamme in closing the discussion stated that he was not advocating a higher temperature than was in use at present, but emphasized the fact that temperatures of 125 degrees centigrade are to be found in machines now in operation and which have been running for years, where mica insulation has been used. He thought that many temperature measurements were incorrect and that actual temperatures of, say, 125 degrees existed where the measurements showed only 80 or 90 degrees. He considered mica at 125 degrees safer than ordinary insulation at 90 degrees. In some cases he had found the hottest point of the field coil as high as 150 degrees, and no trouble has resulted. He had even seen fibrous insulation in fields running for three months at 125 degrees.

Meeting of Northwestern Cedarmen's Association.

The annual meeting of the Northwestern Cedarmen's Association was held in Duluth, Minn., January 7 and 8. This meeting was considered by many to have been the most successful in the history of the organization. An important feature of this meeting was the change in the order of meeting from annual to semi-annual, in January and July, and a suggestion for a change in the name of the association.

Upon roll call the attendance proved to be over two-thirds of the membership. Retiring President T. P. Bradley, of Duluth, in the annual address outlined the progress of the association with regard to the question of interinsurance. This included the organizing of the Cedarmen's Exchange, and Mr. Bradley stated that any of the members who were not carrying a portion of their insurance in this exchange were missing a good thing. He indicated that the report of Robert H. Ross, manager of the exchange, would show that the different policy holders will have credited to their account approximately 80 per cent of the premiums paid and that the exchange had paid all losses with the first fire fund which is made up of interest on investments and actually earned premiums on policies that have been cancelled. On insurance written in the Cedarmen's Exchange the same rate has been paid as would be paid by other insurance companies, and as about 80 per cent of the premiums paid stand today to the credit of the respective accounts, this meant that the insurance so written up cost about 20 per cent, or about one-fifth of what it would otherwise have cost. Ernest L. Clark is chairman of the insurance committee. The exchange will also be a valuable asset to the association from the standpoint of acquiring new members. Only members of the Northwestern Cedarmen's Association are entitled to place their insurance with the Cedarmen's Exchange. Mr. Bradley pointed out several specific instances of where membership in this direction worked to the advantage of the member.

Mr. Bradley called attention to the importance of the Interstate Commerce Commission's Order No. 4631 in the matter of the investigation of alleged irregularities and discrepancies in the weighing of freight by carriers. A number of hearings have been held at various points throughout the country. At Chicago, Mr. Benham, representative of the association, was very much in evidence and there would be presented to the meeting an opportunity to read a transcript of the evidence

secured at the Chicago meeting. He dwelt to a considerable extent on the technical features of freight rates on cedar products and their relation to existing and possible tariffs. He emphasized the condition of strain on railroad track scales and of the necessity of protective measures against mishandling and clerical errors in the recording of weights or transposition of figures.

He called attention to the improvement in business during 1912, and said that the cedarmen were gradually climbing back again and that the outlook for the year's business was very encouraging. Post business last year was about on a par with 1911. The pole business had shown some improvement. At the present time stocks are broken, with a marked shortage in some sizes. The tie situation is getting back to where it was a few years ago. There are practically no ties on hand except the new cut coming out this winter. The pulpwood situation, at least in the Minnesota district, is not quite satisfactory, and Mr. Bradley

Thomas P. Bradley,
Retiring President.

presented some facts for the careful consideration of the members.

The secretary's report presented statistics governing stocks on hand January 1, 1913, and shipments for 1912. The estimated input for 1912-1913 will be about 1,000,000 less than the year previous. He stated that there had been 22 calls for inspection during the last year, 13 of which were for poles, and none for posts, sixteen of these inspections being made by the secretary. He presented facts and figures relating to the Bemidji Weighing Association, and urged that steps be taken at the present session of the Legislature to secure the enactment of a law giving the Railway and Warehouse Commission the same authority over weighing lumber and forest products which it now has over hay, grain and coal.

The treasurer's report showed a balance on hand January 1, 1912, of $453.91; receipts during the year, $2,803.91; disbursements, $2,940.15; balance on hand December 31, $317.67.

At the Wednesday morning session a committee was appointed to discuss the advisability of changing the name of the association from the Northwestern Cedarmen's Association to the Northern White Cedar Association, and to report at the next annual meeting.

After much discussion of the proposition of including Bemidji with Rexton as a basing point in determining freight rates it was decided to retain Rexton as a basing point.

The following officers were elected for 1913: President, W. C. Moss, Minneapolis; vice-president; J. W. Benham, Chicago; treasurer, W. B. Thomas, Manistique; secretary, H. H. McKinney, Minneapolis. Directors for two years: E. L. Clark, Minneapolis, and H. W. Reade, Escanaba. The directors retaining office are: M. K. Bissell, Escanaba, and L. A. Page, Jr., Minneapolis.

The directors met promptly after adjournment and appointed a secretary and treasurer, reappointing practically all of the old committees for another year. The special membership committee consisting of M. K. Bissell, H. F. Partridge and A. D. MacIntyre, were held over.

The annual banquet was held at the Spalding Hotel, and a delightful spread and entertainment thoroughly enjoyed.

Among those present were the following:

Robert H. Ross, Robert H. Ross Company, Chicago. T. M. Partridge, T. M. Partridge Lumber Company, Minneapolis. J. W. Naugle, Naugle Pole & Tie Company, Bemidji. E. D. Agler, T. M. Partridge Lumber Company, Minneapolis. F. W. Wilhelmi, Cloquet Tie & Post Company, Cloquet. A. D. MacIntyre, National Pole Company, Duluth. James Meloney, Meloney Brothers, Spooner, Minn. H. H. McKinney, secretary Northwestern Cedarmen's Association, Minneapolis. M. H. Schussler, Collidge, Schussler Company, Minneapolis. H. B. McMeal, president Telephony Publishing Company, Chicago. E. L. Clark, Valentine-Clark Company, Minneapolis. L. H. Clark, Valentine-Clark Company, St. Maries, Idaho. C. W. Forbrich, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Chicago. L. A. Furlong, Valentine-Clark Company, Minneapolis. Harry Worth, Crawford Cedar Company, Menominee, Mich. William S. Patch, Crawford Cedar Company, Menominee, Mich. M. Sperry, MacGillis & Gibbs Company, Milwaukee. T. P. Bradley, Duluth Log Company, Duluth. H. W. Reade, National Pole Company, Escanaba. H. F. Partridge, T. M. Partridge Lumber Company, Minneapolis. J. W. Benham, Naugle Pole & Tie Company, Chicago. H. M. Dixon, Cloquet Tie & Post Company, Cloquet. H. M. Clark, Clark Pole & Tie Company, Bemidji. M. J. Rice, White Marble Lime Company, Manistique. M. K. Bissell, Erickson & Bissell, Escanaba. E. C. Bradley, Duluth Log Company, Duluth. W. C. Moss, McCulloch & Moss Lumber Company, Minneapolis. L. A. Page, Jr., Page & Hill Company, Minneapolis. Elmer N. Whyte, Curry & Whyte, Duluth. B. G. Dahlberg, St. Paul, Minn. V. A. Anderson, Duluth Log Company, Duluth. Louis C. Olson, Minneapolis, Minn. John F. Hayden, Minneapolis. George Knox, Perley-Lowe & Company, Chicago. James Jeffery, Duluth Log Company, Duluth. A. K. Martin, Duluth. Roy Thompson, Minneapolis. H. B. Darlington, *American Lumberman*, Chicago.

W. C. Moss, the newly elected president, was born in the little town of Osage, Iowa, and left there in 1887 to engage in the wholesale building ma-

W. C. Moss,
President-Elect.

terial business, making his headquarters at Superior, Wis., for 17 years. In this business he became acquainted with the lumber trade throughout Minnesota, Montana, North Dakota, South Dakota and Iowa. He went to Minneapolis in 1904, establishing with John McCulloch the McCulloch & Moss Lumber Company. Mr. McCulloch is one of the pioneers of the Northwest in the operation of line yards.

New General Electric Company Vice-Presidents.

At a meeting of the board of directors of the General Electric Company, held December 30, last, J. R. McKee and O. D. Young, both of New York, were elected vice-presidents of the company. At a previous meeting of the board, Anson W. Burchard, of New York, was also elected a vice-president of the company.

Boston Vehicle Meeting.

A joint meeting of the New England Section of the Electric Vehicle Association of America and the Electric Motor Car Club of Boston was held at the Hotel Thorndike, Boston, Mass., on Friday evening, January 10. Arthur Williams, president of the former organization, made the principal address of the evening, his subject being "The Development of the Motor Vehicle." Mr. Williams brought out the facts that of the 30,000 electric vehicles now in use in this country, about 6,000 pleasure cars and 4,000 trucks had been manufactured during the year 1912. Several models built in 1899 are still in use, and one truck built as early as 1893 is today in constant practical use in Philadelphia. This truck holds a record of four years' service without a day's lapse. The speaker said that central-station people are becoming aroused to the value of the electric-vehicle load and service. During the year between the summer of 1911 and that of 1912 the number of electric vehicles in service increased 45 per cent. During the past two years electric trucks in Chicago have increased in capacity 400 per cent. The Boston Edison Company was accorded high praise for the effectiveness of its electric-vehicle campaign, and the labors of W. H. Blood, Jr., were highly commended in connection with the development of the industry. The campaign begun two years ago by the Public Service Corporation of New Jersey has resulted in an increase in the number of electric vehicles in its territory from 139 to 440, while the average cost of charging has been reduced from a little over 4 cents per kilowatt-hour to about 3.5 cents. In the past three years in Boston and vicinity the number of commercial electrics has risen from about 60 to nearly 300. About 80 per cent of the commercial vehicles in the country are in use east of the Alleghanies, while the heaviest demand for pleasure cars is found in the Middle West. It is interesting to note that there are 2,200 electric pleasure cars in use in Chicago, and in New York there are 1,700 trucks and delivery wagons. Mr. Williams recounted the Association's activities in bringing together the manufacturers, central-station managers and manufacturers of accessories. In two years the Association has grown from the original 29 members to 350, who represent 17 manufacturers, 56 central stations and 10 manufacturers of accessories. The charging plug has been standardized, and the garage sign, the campaign of advertising and the general stimulus to the business were dwelt upon. The coming year it is planned to raise a fund of at least $42,000 for publicity. Ten years ago the price for charging was about 23 cents per kilowatt-hour generally throughout the United States; today the rate is from 5 cents down to as low as 3 cents. The price of gasoline has risen meanwhile from 10 cents to 24 cents per gallon, with a prospect of even higher prices. The price of electrical energy, particularly for off-peak loads, tends still lower than at present.

Mr. Williams stated that the New England Casualty Company, of Boston, has notified the Association that it is to grant a substantial reduction of rates to electric vehicles—a decrease which will bring the rate of insurance about 20 per cent below the rates for gasoline machines. The speaker emphasized the importance of the electric truck as a means of raising the efficiency of terminal and warehouse delivery service. Electric trucking at night would facilitate the moving of merchandise, and diminish street congestion. Mr. Williams urged the Association's further usefulness in promoting co-operation, standardizing equipment and establishing new branches. It should stimulate the manufacturer, the central station and the public to enlarged uses of the electric vehicle.

In the discussion that followed the address, Past-president Blood cited the increase of per capita travel in the country, which has amounted in certain cities to 100 per cent in the past ten years.

Converse D. Marsh called attention to the stupendous advantage of vehicles propelled by power derived from a central station, in contrast with the thousands of isolated plants (horses) moving about the streets on four legs. He gave $190 per year as a fair average cost of horse feed and bedding, a sum which should be turned into the coffers of the central stations, to be transmitted again with vastly enlarged transportation efficiency.

W. P. Kennedy described an investigation of stables and horse feeding in New York. There are 120,000 horses in the metropolis and the feed bill is $27,156,000 per year.

Harold Pender emphasized the saving in time to be made by the use of motor trucks in railway yards, based upon a recent investigation. The delays in backing, loading and moving in congested areas are greatly reduced by the use of the truck.

E. W. M. Bailey stated that the electric pleasure car now performs about 90 per cent of the service required by the average automobile owner, at 25 per cent less cost.

D. C. Tiffany told of one owner who had sold his gasoline car and bought an electric, hiring a gasoline car for long trips. The resulting economy was great.

M. J. Fitch, S. F. Smith, and Day Baker also spoke.

F. J. Stone said that interchangeability of batteries should present no mechanical difficulties where conditions make it desirable.

National Automobile Show in New York.

The National Automobile Show opened in New York on January 11 with two exhibitions, one at Madison Square Garden and the other at the Grand Central Palace, both places being completely filled with exhibitions of automobiles and accessories. The present exhibition, which consists of pleasure vehicles only, continues throughout the present week. Next week the commercial vehicles will replace the others and remain on exhibition until January 25.

Very few electric vehicles are on exhibition, and this apparently is explained by the statement that the manufacturers of such vehicles are not pleased with the treatment accorded them, and are planning to unite and have an exhibition of their own. At the present time there are several exhibitions of electric cars in different parts of the city, but with the exception of two or three manufacturers, no exhibits are to be seen at Madison Square Garden or the Grand Central Palace.

Manufacturers of storage batteries are represented as follows: Electric Storage Battery Company of Philadelphia, Pa.; Gould Storage Battery Company, of New York City; Willard Storage Battery Company, of Cleveland, O.; United States Light & Heating Company, of New York City and Niagara Falls, N. Y.; Philadelphia Storage Battery Company, Philadelphia, Pa.

Among those engaged in the manufacture of accessories of an electrical nature are the following companies: Splitdorf Electrical Company, Newark, N. J.; Remy Electric Company, Anderson, Ind.; Connecticut Telephone & Electric Company, Meriden, Conn.; Detroit Electric Appliance Company, Detroit, Mich.; Kokomo Electric Company, Kokomo, Ind.; Joseph Dixon Crucible Company, Jersey City, N. J.; Heinze Electric Company, Lowell, Mass.; International Acheson Graphite Company, Niagara Falls, N. Y.; Dean Electric Company, Elyria, O.; Electric Auto-Light Company, Toledo, O.; Blake Spark Plug Company, Boston, Mass.; Pyrene Manufacturing Company, New York, N. Y.; North East Electric Company, Rochester, N. Y.; Ward Leonard Electric Company, Bronxville, N. Y.; General Electric

Company, Schenectady, N. Y.; Leeds & Northrup, Philadelphia, Pa.; Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The use of electrical equipment is much more in evidence this year than last. The electric starter is evidently coming into its own, and there are few manufacturers who do not equip their cars with it this year, and, in addition, with complete dynamo electric-lighting systems. The Peerless Motor Car Company, of Cleveland, has on exhibition its six-cylinder car with a thoroughly efficient electric starting device, and with it this large car may be cranked by simply pressing a pedal at the bottom of the driver's compartment.

The exhibitors of electric vehicles are the Buffalo Electric Vehicle Company, of Buffalo, N. Y.; Columbus Buggy Company, Columbus, O.; Standard Electric Car Company, Jackson, Mich., and the Church-Field Electric Company, of Sibley, Mich., Mr. Field, of the latter company, being in personal attendance and exhibiting two machines, one of which is an electric roadster built on a novel design which has attracted a good deal of attention.

The Western Electric Company exhibited the "Chauffeur 'Phone," a novel and convenient addition to the automobile.

The Electric Storage Battery Company is making a specialty in its exhibit of exide batteries for automobile lighting and self-starting.

Copper Exports.

Exports of copper for the week ending January 9 totaled 5,937 tons; since January 1, 6,147 tons; same period last year, 10,743 tons.

Pulmotors Adopted in New York.

The New York Edison Company has purchased a number of pulmotors, which have been placed in the Waterside generating station and in each of its substations, and the men have been trained in the proper use of the apparatus. This training has been accomplished through the organization of classes in the various departments, each class numbering 12 men, who meet at some appointed time during working hours. In a brief lecture a company physician explained when artificial respiration should be applied and demonstrated the old method of administering such aid. He also explained the mechanical construction of the pulmotor and showed it in actual use. Then the men paired off in turns as operator and patient and were given practical demonstrations in the use of the pulmotor, as shown in the accompanying illustration. After this work they were shown how to take the machine apart and reassemble it.

New York Edison Pulmotor Class.

While there has been little use for the apparatus among the employees, nevertheless their services have been in frequent demand by physicians and hospitals, and arrangements have been made with the police and fire departments whereby either may obtain the use of one of the Edison machines.

Minneapolis Jovians to Hold Rejuvenation.

The Minneapolis Jovians will hold a rejuvenation and joviation at Odd Fellows' Hall, 703 Hennepin Avenue, Minneapolis, on January 31, at 8 p. m. Every effort is being made to arouse the greatest enthusiasm and it is expected that the efforts of C. E. Hansing and J. M. Hannaford, Jr., statesman for Minnesota, will meet with success. Leo H. Cooper and B. O. Horton are alternate statesmen for Minnesota. Entertainment is in charge of Ralph Geeseka, George W. Hall and Fred G. Dustin. The banquet is in charge of J. L. Bernard, Leo H. Cooper and M. V. Rutherford. The degree team is made up as follows: R. W. Clark, Jupiter; J M. Hannaford, Jr., Avrenim; Ray Burnham, Neptune; C. C. Curry, Pluto; B. F. Smith, Hercules; Ralph Geeseka, Vulcan; Charles Dubsky, Mars; Dewitt Becker, Apollo; C. E. Hansing, Mercury.

Chicago Section of Electric Vehicle Association Discusses Future of the Automobile.

At the regular monthly meeting of the Chicago Section of the Electric Vehicle Association at the Traffic Club on Tuesday, January 14, A. B. Hulit, managing director of the American Agricultural Building and Exposition Company, made a short address on Chicago's future in the automobile trade. Mr. Hulit called particular attention to the development of trade with agricultural people in the vicinity of Chicago and the nearby states. His attention had first been directed to the matter in connection with his work as commissioner-general of the National Association of State Immigration Officials. In looking into the matter of holding land shows in Chicago it became apparent that there was an opportunity for the establishment of an exposition building on a magnificent scale, and subsequent developments had found that practically every governor in the country was ready and willing to work for the promotion of a national exposition building in which permanent exhibitions of natural resources could be held and where civic enterprises of every description might be carried on. A feature of this building will be the large amount of exhibit space set apart for the exposition of automobiles of every description, and especial attention will be paid to the provisions for electric vehicles. There will be provided on the roof an automobile track one-third of a mile long. The roof will be walled to a height of about 10 feet, and then the side walls and roof will be entirely of glass. This will make it possible for automobile manufacturers to make demonstrations in any kind of weather.

Mr. Hulit suggested that the Chicago section appoint a committee to have the National Organization investigate the matter of having permanent headquarters in this building and establishing a permanent exhibit of electric vehicles.

Mr. Hulit was followed by Governor R. S. Vessey of South Dakota, who spoke very warmly of the necessity and great advantage of electrical men contributing

to the development of rural communities. Governor Vessey pointed out that every time a farmstead was established it developed a prolific source of revenue for the manufacturers of every kind of material, and that the co-operation of the Electric Vehicle Association would be a very important step in the development of the complete resources of the building which had been planned.

The secretary of the Chicago section was empowered to select a suitable meeting place adjacent to the automobile shows which will be held at the Coliseum and First Regiment Armory for the next meeting of the section. A resolution was adopted requesting the board of the Electric Vehicle Association to investigate the desirability of holding the 1913 convention in Chicago.

The Myriawatt.

At a joint meeting of the Standards Committee of the American Institute of Electrical Engineers, and of a committee specially appointed for the conference by the American Society of Mechanical Engineers, on December 13, 1912, the following resolutions were unanimously adopted, and have been duly reported to the governing boards of the two societies:

Whereas, the "myrowatt" or "myriawatt" was suggested by Mr. H. G. Stott as a convenient unit of power only two per cent larger than the most recently determined values of the "boiler horsepower," and,

Whereas, a paper setting forth the advantages of the use of the "myriawatt" as a unit of power in dealing with the performance of steam boilers, steam engines, gas engines, steam and water turbines was read by Messrs. H. G. Stott and Haylett O'Neill before the annual convention in Boston of the American Institute of Electrical Engineers in June, 1912, was discussed, and was published in the Proceedings of the Institute, and

Whereas, the American Society of Mechanical Engineers has appointed a special committee to confer with the Standards Committee of the American Institute of Electrical Engineers upon this unit, as presented in the said paper, be it

Resolved, (1) That the two committees in joint session recommend to their respective societies the use of the "myriawatt" as unit of thermal or mechanical power, as indicated in the above mentioned paper.

(2) That the two committees also jointly recommend to their respective societies the exclusive use of the "myriawatt" in connection with boilers, producers, turbines and engines and discontinue the use of the term "boiler horsepower."

(3) That Mr. C. O. Mailloux as representing Mr. H. G. Stott on the special committee on "Prime Movers" recently appointed by the International Electrotechnical Commission, which committee it scheduled to meet at Zürich, Switzerland on January 19, 1913, shall be and hereby is requested to bring these joint resolutions formally to the notice of that body at Zürich.

(4) That the two committees jointly recommend that in writings and publications the "myriawatt" and "myriawatt-hour" be abbreviated to mw. and mw-hr. in conformity with the existing abbreviations kw. and kw-hr. for kilowatt and kilowatt-hour, respectively.

The resolutions indicate and recommend a simple and satisfactory method of rating the input and output of turbogenerators, in terms of one and the same unit—the international watt. Instead of rating the output of a turbogenerator in kilowatts, and the input in boiler horsepower or other heat units as at present, it becomes very convenient to rate the electric output in kilowatts, and the steam input in myriawatts, because the myriawatt is approximately the same as the boiler horsepower while it is also exactly 10 kilowatts. By this means the long existing incongruity of stating the input and output in different and disconnected units of power will be eliminated.

This is the first piece of joint standardization work that has been accomplished between two of the national sister engineering societies having their homes in the Engineering Societies Building of New York City, and it is to be hoped that this may be the starting point for much good joint action of a similar nature.

Electrical Exports for November.

The Bureau of Foreign and Domestic Commerce, Washington, D. C., has issued its monthly summary of imports and exports of the United States for last November. From this are obtained the following data relative to the electrical exports for that month.

The total value of these exports for November exceeds that of any preceding month for which official records have been kept. The preceding record month was August, 1912, but the total for November exceeds it by nearly $170,000. The following table gives the detailed figures according to the new classification:

Articles.	No.	Value.
Dynamos and generators		$ 192,424
Motors		268,107
Fans	907	11,730
Arc lamps	792	12,199
Carbon-filament lamps	141,068	20,188
Metal-filament lamps	130,084	34,291
Telegraph instruments (including wireless)	6,303	8,944
Telephones	124,368	115,752
All other	824,535	1,606,918
Total, November, 1912		$2,270,553
Total, November, 1911		1,679,566

Production of Copper in 1912.

Statistics and estimates received by the United States Geological Survey from all plants known to produce blister copper from domestic ores and from all Lake mines indicate that the copper output of the United States in 1912 exceeds that of any previous year in the history of the industry. Not only is the total output the largest ever recorded, but six of the large copper-producing states—Arizona, Michigan, Utah, Nevada, New Mexico, and Alaska—have each exceeded all former records of production, while Montana and Tennessee have nearly equaled their previous record productions.

Smelter Production.

The figures showing smelter production from domestic ores, which have been collected by B. S. Butler, of the Geological Survey, represent the actual production of most of the companies for eleven months and an estimate of the December output. The November figures for a few companies were not available and these companies furnished estimates for the last two months of the year. According to the statistics and estimates received, the output of blister and Lake copper was 1,249,000,000 pounds in 1912, against 1,097,232,749 pounds in 1911.

At an average price of about 16 cents a pound the 1912 output has a value of nearly $200,000,000, against $137,154,092 for the 1911 output.

Preliminary statistics showing the output of refined copper are not collected by the Geological Survey. Figures published by the Copper Producers' Association show an output of 1,429,147,150 pounds for the first 11 months of 1912 and indicate that the production of marketable copper by the regular refining plants from all sources, domestic and foreign, will amount to about 1,560,000,000 pounds for 1912, against 1.433,875,026 pounds in 1911.

Imports and Exports.

According to the Bureau of Statistics imports of pigs, bars, ingots, plates, and old copper for the first 11 months amounted to 276,508,505 pounds, and the copper content of ore, matte, and regulus imported amounted to 94,486,041 pounds. If the imports for December were equal to the average monthly imports for the first 11 months the amount of copper entering the United States for the year was about 404,721,323 pounds, against 334,607,538 pounds for 1911. Considerable of the copper imported as blister had been previously exported as ore.

Estimates based on figures for the first 11 months published by the Bureau of Statistics and also by the Copper Producers' Association indicate that the exports of copper for 1912 will not equal those of 1911 but may exceed 750,000,000 pounds.

Stocks of refined copper held in the United States January 1, 1913, are probably about the same as on January 1,

1912. Foreign stocks show a considerable decrease.

Domestic Consumption.

Statistics published by the Copper Producers' Association show the domestic deliveries for the first 11 months of the year as 761,174,225 pounds and indicate a marked increase in domestic consumption, which will probably reach 825,000,000 pounds for the year and may exceed that amount.

The average quoted price of electrolytic copper for the year showed a marked increase over that for 1911. The average for 1912 was about 16 cents a pound, as compared with 12.5 cents a pound for 1911. The year opened with copper at about 14 cents a pound, but since June the monthly average has not been below 17 cents.

Leading Copper-Producing States.

For 1912 Arizona again holds first place among the copper-producing states. The output will show a large increase over the 303,202,000 pounds produced in 1911 and may exceed 350,000,000 pounds. This is not only the largest output ever made by the state but the largest ever made by any state for one year.

The copper output of Montana shows a large increase over the 271,814,491 pounds produced in 1911, owing to the stimulation to production given by the increase in the price of copper. The 1912 output may reach 310,000,000 pounds. The Butte district, as in previous years, was the only large producer. Montana ranked second in copper production in 1912. Important additions to the ore reserves of the Butte district are reported and improvements have been made in the methods of extracting and treating the ores with a view to decreasing the cost of production.

The production of copper from Michigan, which ranks third among the copper-producing states, shows an increase of nearly 15,000,000 pounds over the output of 218,185,235 pounds in 1911. The output was made largely by the old producers and the increase was due to the stimulation of higher metal prices. Development of new territory has been active during the year.

The production of copper in Utah in 1912 shows a considerable increase over the 142,340,215 pounds produced in 1911, the increase being due to the increased output of the Bingham district.

The copper production of Nevada in 1912 shows a large increase over the 65,561,015 pounds produced in 1911. The increase is due largely to the beginning of noteworthy production from the Yerington district. The total state output for 1912 will probably reach 80,000,000 pounds.

The production of copper in California in 1912 shows little change from the 35,835,000 pounds produced in 1911. As in previous years the Shasta County district was the largest producer.

The output of copper from New Mexico in 1912 shows a large increase over that of 1911, owing to the beginning of noteworthy production by the Chino Copper Company, of the Santa Rita district. The total production of the state will reach nearly 30,000,000 pounds.

Alaska shows a large increase in 1912 over the 22,314,000 pounds produced in 1911, the total having been estimated at 28,940,000 pounds. The output came largely from the Copper River and Prince William Sound districts.

Outlook for 1913.

There will be no new large producing mines added during 1913. Several of those that began production in 1911 and 1912 will, however, turn out larger quantities than in 1912. At the prices for copper prevailing during the latter part of 1912 the industry is highly profitable, and if the output can be marketed and the price maintained the producers will be in a position to make a still further large increase in 1913.

Voltaic Cells Containing One Salt in Two Solvents.

The sixty-sixth meeting of the Faraday Society was held on December 10, 1912, at the Institution of Electrical Engineers, London. A. P. Laurie delivered a lecture on "Voltaic Cells Containing the Same Salt Dissolved in Two Different Solvents."

If a salt is shaken up with two different liquids which do not mix, and in both of which the salt is soluble, the salt is shared between the two liquids in definite proportion. For dilute solutions this proportion remains the same, and the ratio is known as the partition coefficient. If after shaking up together the liquids are allowed to separate from each other and two similar electrodes are introduced, there will be no electromotive force between the electrodes.

If instead of two liquids which do not mix, we select two liquids which do mix, the problem is complicated by their mixing at the boundary, and so forming intermediate solvents, and therefore for their proper investigation we must imagine them separated by a third solvent which mixes with neither, but the different solubilities of the salt in each liquid will produce an electromotive force, and enable us to determine the partition ratio electrically.

In order to investigate these cells he used little stoppered vessels inverted and plunged in the solution, and a Dolazelek electrometer. Such stoppers, if not greased, form a sufficient electrical connection, while preventing mixing. The cells used consisted of potassium iodide and iodine, dissolved in water and nitrobenzene, with platinum electrodes; potassium iodide and iodine dissolved in water and ethyl alcohol, with platinum electrodes; and potassium iodide in water and ethyl alcohol, with silver, silver-iodide electrodes.

The first experiments were with the view of testing the effect of temperature on the cells.

If we plot concentration against electromotive force for two different temperatures in ordinary concentration cells, keeping the concentration the same on one side and changing it on the other, then the curves cross at zero the electromotive force and with the reversal of the electromotive force the temperature-coefficient is reversed, the cells being always endothermic and the temperature-coefficient positive.

In the cells under discussion, with the reversal of the electromotive force, the temperature-coefficient is not reversed, the cell becoming exothermic and giving out heat as well as producing an electric current.

If we take the case of potassium iodide in water and alcohol, the cell is exothermic when the current is in the direction of transferring potassium iodide from water to alcohol, the ratio of about 1 to 20 being the concentration of no electromotive force.

If a cell is constructed which has no electromotive force at a temperature, T_1, then on raising the temperature to T_2 a current flows in the direction to transfer potassium iodide from alcohol to water, and the cell is endothermic. On now cooling to T_0 the current is reversed and the cell is exothermic, but potassium iodide being re-transferred from water to alcohol, the whole forming a very neat heat engine.

It is evident that if the rate of change of solubility of the salt with temperature was the same in both solutions, then on raising or lowering the temperature no electromotive force would be produced.

Experiments proving these conditions of electromotive force with temperature were made with the three types of cell already described. In iodine, potassium-iodide, alcohol, water cells with 0.025 molecule of potassium iodide on each side, the equilibirium for iodine is 0.0138 molecule in water against 0.086 molecule in alcohol.

Electric Sign for Savings Bank.

A novel electric sign will be erected in front of the Pennsylvania Trust Company Building, 536 Penn Street, Reading, Pa. The sign will stand vertically and will have a hand dropping coins in a savings bank. The sign will require 520 lamps when it has been completed.

THE CALIBRATION OF PHOTOMETRIC STANDARDS.

By R. W. Shenton.[1]

The rapid development of the science of illumination during recent years calls more and more for accuracy of photometric measurement. Precision photometers are prerequisites for good quantitative work, but of still greater importance are reliable photometric standards. All of our measurements and all of the distribution curves used in our discussions are dependent for their worth upon the standards by means of which they are obtained. Further, the life performance and efficiency of the millions of incandescent lamps manufactured every year depend upon the reliability of the standards against which these lamps are rated. In the face of these facts, the need of dependable standards is obvious.

Up to the present time, no lamp has been found so reliable and convenient for maintaining a constant light intensity as the electric incandescent lamp. It gives an intensity of light that is capable of minute adjustment and which is constant for a reasonably long period of time. The constancy of this lamp is not impaired by variation of atmospheric conditions.

No one has realized the necessity of having good standards more than have the manufacturers of incandescent lamps themselves. The Engineering Department of the National Electric Lamp Association has taken every possible precaution to insure accuracy in this line of work. The several operations of making standards are definitely outlined on printed instruction sheets; the instruments used are calibrated at stated intervals; readings are repeatedly checked so as to avoid all possibility of errors of a personal nature. Since the National organization maintains one of the few standardizing laboratories in the country and since from this laboratory standards are quite widely distributed, a description of the apparatus used and the methods pursued may be of interest.

The equipment consists essentially of two 120-inch precision photometers placed in separate rooms and operated by different individuals. For convenience we will refer to these photometers as Nos. 1 and 2, respectively. Both photometers have Lummer-Brodhun contrast screens, with which an accuracy corresponding to one-tenth of one per cent in voltage can be obtained. The equipment of photometer No. 1 includes a potentiometer with which all current and voltage measurements are made. Current and voltage readings on No. 2 are made on laboratory standard meters. The current for the lamps is obtained from four separate storage batteries, which are charged weekly so that their voltage is kept uniform.

All photometric measurements in this work are made by the substitution method. A description of this method follows. The working standard is placed in one end of the photometer—the testing end—where it can be rotated at any desired speed; a comparison lamp is inserted in the other or comparison end of the photometer and is calibrated against the working standard; the working standard is then replaced by the lamp to be measured and readings are taken. This method is decidedly more satisfactory than the comparison method, in which a standard is placed in the comparison end and the unknown lamp measured by direct comparison with

Fig. 1.—Precision Photometer.

the standard. One reason for this is the fact that in the substitution method the working standard is only used a few minutes each day, while in the comparison method the working standard is used all day. Hence the life of the working standard is *very* much greater in the substitution method. Reference standards are obtained from the Bureau of Standards at Washington. These are interchecked monthly by the Engineering Department.

The first step in the process of standardization is the selection of the lamps. Carbon lamps are selected from the regular factory stock. Mazda standards are made up specially with formed drawn-wire filaments of the hairpin type supported at the tips by means of double-coil spring supports and fused at the ends to rigid supports. Commercial Mazda lamps are not used because they are subject to a very slight variation in resistance, due to the varying temperature at the supporting hooks. Each lamp is carefully inspected for mechanical defects,—crooked bases, poor fusing, unsymmetrical filaments, filaments not properly centered, bubbles or streaks in the glass,—any one of which will be sufficient cause for the rejection of the lamp. Lamps defective in vacuum are, of course, discarded.

After the lamps to be standardized have been selected, they must be rated. By rating is meant the determination of the voltage at which a given lamp must be operated in order that it may burn at a certain efficiency. Lamps of all classes are rated at commercial high efficiency. Before the lamps are ready to be used as standards they are seasoned or aged to a point where their resistance becomes practically constant. Ideally this aging would be accomplished by burning the lamps at normal (rated) voltage until the desired conditions were reached. This process, however, would take considerable time; therefore, they are operated at a forced voltage, usually with a correction factor of 60, that is, one minute at forced voltage is equivalent to an hour at normal voltage. In the case of carbon lamps a life-resistance curve is run for each lamp. This curve will show when the point of constant resistance has been reached, usually after a period of from 50 to 60 hours burning for 130-volt class and 60 to 80 hours for 260-volt class. All curves are kept for possible future reference. For various reasons Mazda lamps operating at two watts per candle are used for Gem standards. All Mazda lamps are aged for from 25 to 30 hours. Repeated experiments have shown that the Mazda lamp possesses constant characteristics after a period of from 20 to 25 hours, and for this reason aging curves are unnecessary.

The photometering of standard lamps is carried out with extreme care, for upon this step more than any other, depends the value of the standard. An ordinary comparison lamp of the same type as the lamp to be measured is placed in the comparison end of the photometer No. 1. A carefully standardized working standard, also of the same type, is placed in the testing end, its voltage adjusted and the lamp rotated at the proper speed. The sight box is set at a point which indicates the desired comparison-lamp candlepower and the voltage on the comparison lamp adjusted until a photometric balance is obtained. This voltage is recorded. The same operation is repeated with three different working standards of various candlepowers, the sight box in each being set at the proper point and the com-

1 Engineering Department, National Electric Lamp Association.

parison-lamp voltage found. The average of these voltages is taken as the proper comparison-lamp voltage.

The comparison-lamp voltage is fixed at the value just found, a working standard placed in the testing end and the sight box set at a point corresponding to the rated candlepower of the standard. The voltage on the latter lamp is varied until a balance is obtained. This final voltage, when compared with the rated voltage of the standard, serves as a check on the comparison lamp.

Now that the comparison lamp has been calibrated, the new lamps can be measured. One of the lamps selected to be standardized is placed in the testing end of the photometer, the sight box set as before and the voltage on the new lamp varied until the spot is balanced. Two men take ten readings each. Both of these sets of readings are averaged and the average of the two results is computed.

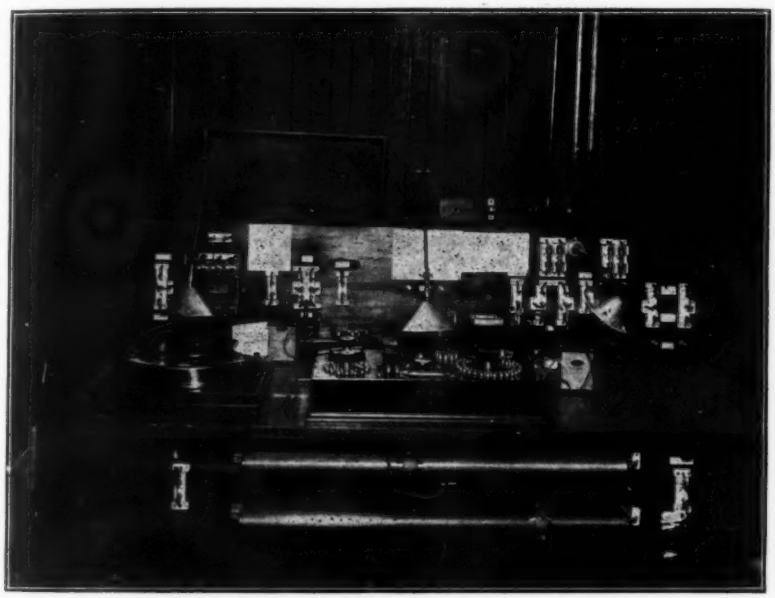


Fig. 2.—Electrical Equipment of Photometer.

The lamp is then sent to photometer room No. 2, where similar sets of readings are taken against a different comparison lamp and by different operators. These readings are recorded and averaged as before. The difference between the final average of photometer No. 1 and that of photometer No. 2 must not exceed 0.2 of one per cent. The average of these two results is taken as the operating voltage of the lamp.

The current consumption at this voltage is determined by potentiometer measurement, and the watts per candle ascertained. There are two reasons for measuring the current; first, the current at a given voltage is a check on the candlepower, for if at any future time this current is noticed to have changed it is a sure indication that the candlepower is no longer correct; second, the watts per candle must be between certain limits as determined by practice, so that color differences will be minimized.

All the data for a given lamp are recorded on a certificate of standardization. This is properly signed and approved and a blue print is sent out with the lamp. The lamp is then ready for use and will give its rated candlepower under the conditions specified on the label.

The first class or primary reference standards of the Engineering Department are Mazda and carbon lamps, which have been specially standardized. From these lamps are made a second set of reference standards, and from these are made the working standards used in the daily photometric work. These lamps are all interchecked periodically and with so large a number of lamps any changes can be noted and the defective lamp destroyed.

Research Work in England.

An important movement is on foot in England to prevent overlapping in the research work of different societies. The research Work Committee of the Institution of Electrical Engineers has made definite recommendations which that body has just adopted with the object of avoiding covering the same ground as the British Association, the Royal Society and other such bodies. In the future the research work of the Institution of Electrical Engineers will, as far as possible, be confined to the following: (1) The organization and correlation of research work in electrical engineering; (2) The origination and supervision of specific researches in subjects connected with the electrical industry, and the allocation of grants in aid of same.

The organization and correlation of the research work carried on within the sphere of the Institution will include the following: (1) The establishment of a general committee for research to which investigators will be invited to send particulars as to the subject and character of the researches they are undertaking. Members of the Institution, especially those connected with the manufacturing side of the industry, will also be invited to communicate to the committee any special difficulties which they have to encounter which call for investigations, and to make suggestions for subjects for research. The General Committee will thus act as a species of "clearing house" for research topics, receiving suggestions from various sources and sending them on after consideration to the most suitable quarters.

(2) The collection and publication of particulars of plant available for special testing and investigation work in the various laboratories together with a list of the subjects in which researches have been carried out.

(3) The compilation and publication of bibliographies of specific fields of research. The committee thinks it desirable that the Institution should originate and direct researches in certain subjects, and it suggests that as a committee, it shall be empowered to appoint sub-committees of experts to deal with researches in select subjects. It is proposed that in the first instance a series of investigations might be initiated on the electrical properties of materials which would deal with such matters as magnet steel, copper, carbon, paper, rubber, mica, porcelain, oils and varnishes, etc., for which fuller data are required.

Large Coal Mines.

There are 735 coal mines in the United States which are producing more than 200,000 short tons of coal each annually. In 1911, according to a statement by Edward W. Parker, the coal statistician of the United States Geological Survey, 269 bituminous mines and 168 anthracite mines in Pennsylvania produced in excess of this amount. The average production of these Pennsylvania bituminous mines was 321,773 tons and of the anthracite mines 444,697 tons. The largest anthracite mine had a production of 1,020,420 long tons (1,142,870 short tons). The largest bituminous production from one mine (a Pennsylvania operation) was 1,285,483 short tons.

SAG IN LONG SPANS FOR TRANSMISSION LINES.

By W. T. Ryan.

Very much difficulty is encountered in calculating the sag to be allowed in a long span at a given temperature because of the fact that, as the temperature increases or decreases and the wire lengthens or shortens due to this variation in the temperature, the tension in the wire also decreases or increases, thus causing an elastic elongation or shortening which makes the sag greater or less than it would be if the tension remained constant. The problem is still further complicated by the variations both in tension and elastic elongation due to variations in the wind pressure.

The purpose of this article is to present a simple and direct method of calculating the sag in wires in which due allowance is made for all these variations.

When a wire is suspended freely between supports it takes a curve known in mechanics as a catenary. The exact solution of the properties of this curve is very tedious. For small deflections, such as are encountered in transmission lines, use may be made of the parabola, which approaches very closely to the catenary, if the sag is less than one-twentieth of the span. It is a much simpler curve to compute.

The relation between the length l, the deflection d and the tension T on a wire at the center, as a factor of its weight, is expressed by the formula:

$$T=l^2w/8d \qquad (1)$$

where l=length of span in feet;
d=sag in feet;
w=weight of wire in pounds per foot;
T=tension on wire in pounds.

The tension in the ends of the span AB would be increased by an amount equal to $wd/2$, but as this is usually less than one or two per cent of the whole, it may be neglected.

With no wind the sag would be:

$$d=l^2w/8T \qquad (2)$$

With wind, but without a coating of ice, the sag is:

$$d=l^2W/8T \qquad (3)$$

where

$$W=\sqrt{(w^2+P^2)} \qquad (4)$$

and P=wind pressure in pounds per lineal foot.

The wind pressure is considered as acting at right angles to the direction of the wire, since the maximum tension is produced by a wind at right angles to the direction of the line. The pressure P is given by the formula:

$$P=0.055\ pD \qquad (5)$$

where D=diameter of wire in inches;
p=normal pressure of the wind in pounds per square foot.

The constant 0.055 is obtained by multiplying one-twelfth by two-thirds. According to Langley, in his "Experiments in Aerodynamics," page 24, the pressure on a cylindrical surface, as for example a wire, is about two-thirds of that exerted upon a flat surface of area equal to the diameter of the cylinder multiplied by its length.

$$p=0.0025\ V^2 \qquad (6)$$

where p=wind pressure in pounds per square foot;
V=velocity of wind in miles per hour.

V is usually taken at about 90 miles per hour for its maximum value in the open. Where the force of the wind is broken by buildings, trees, etc., 65 miles per hour is sufficient.

The last equation is based on the results of a series of wind-pressure experiments made at Niagara Falls on a 950-foot span of 0.58-inch cable, erected so as to be normal to the usual wind. These experiments were conducted by H. W. Buck and were presented in a paper read at the International Electrical Congress, St. Louis, in 1904. Wind pressure decreases considerably as one approaches the ground. The New York building code prescribes for high buildings, 30 pounds per square foot.

Since the wind pressure acts at right angles to the line, the sag as given by equation (3) will be at an angle to the vertical depending on the relative values of w and P.

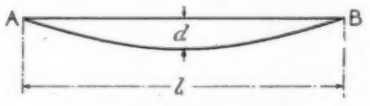


Fig. 1.—Diagram of Span.

The variation in the tension due to temperature is taken care of by making the sag d, as determined by equation (3), the sag to be allowed in the coldest weather, say at —40 degrees Fahrenheit in the northwest. We must then calculate the sag at the temperature at which the wire is being strung. It, of course, would not be practicable to erect the line in a high wind; therefore we will calculate the sag first at —40 degrees Fahrenheit and no wind, then from this obtain the sag at the desired temperature. It is not unusual for lines to be exposed to a temperature of 110 degrees Fahrenheit in the summer.

The wires may also have a coating of ice upon them. The I^2R loss in the line may reduce this considerably. Sleet storms and the very coldest weather seldom if ever come together and it is very improbable that we will have a wind of 90 miles per hour, blowing at right angles to the line, at the same time that we have the coldest weather and sleet. The writer believes therefore that if the tension in the wire does not exceed two-thirds of the elastic limit for minimum temperature and maximum wind pressure without ice, the factor of safety may be considered ample.

If T remained constant, the sag cold, but without wind, would be:

$$d'=wd/W \qquad (7)$$

where d'=sag cold and no wind;
w=weight of wire in pounds per foot;
W=combined weight of wire and the wind pressure in pounds per lineal foot.
d=sag cold and with wind.

The wire has shortened some due to the decreased tension and the actual sag lies somewhere between d' and d. The tension T' corresponding to a sag d' would be:

$$T'=l^2w/8d' \qquad (8)$$

The actual tension will lie somewhere between T and T', hence we assume a value between these two and make a trial solution to see whether our assumed tension and the sag (or length of wire) for that tension correspond. If they do we have assumed a correct value. Suppose we assume a value T''.

The length of wire L' in the span at —40 degrees Fahrenheit and no wind is given by the formula:

$$L'=l+8(d')^2/3l \qquad (9)$$

where l=length of span;
d'=sag at minimum temperature and no wind.

The shortening of the wire due to the decreased tension will be:

$$\lambda=(T-T'')L'/EA \qquad (10)$$

where E=modulus of elasticity;
A=area in square inches.

The modulus of elasticity of copper varies from about 15,000,000 to 18,000,000. The higher value applies to hard-drawn solid wires and the lower value to soft-drawn wires and hard-drawn stranded cables. For aluminium E ranges from 8,000,000 to 10,000,000. For steel E is about 26,000,000. There are very few data generally available on the elastic limit, the ultimate breaking strength and the modulus of elasticity of copper-clad steel wires. Some of the wire manufacturers undoubtedly have such data and would probably gladly publish it if requested to do so.

We next calculate the sag d'' corresponding to the tension T''.

$$d''=l^2w/8T'' \qquad (11)$$

The length of wire L'' corresponding to the sag d'' is

$$L''=l+8(d'')^2/3l \qquad (12)$$

$$L''+\lambda=\text{length if tension were } T. \qquad (13)$$

If equations (9) and (13) give the same values, then T'' is the actual tension and d'' is the actual sag at the minimum temperature and no wind.

The length of wire at a temperature t' and no wind would be given by formula (14) if T'' remained constant.

$$L'''=L''[1+B(t'-t)] \qquad (14)$$

where B=temperature coefficient of linear expansion;
t'=temperature at which the sag is desired;
t=minimum temperature to which the line is exposed.

For copper, B=0.0000095 per degree

Fahrenheit; for aluminium, $B=0.0000130$ per degree Fahrenheit.

The sag d_t corresponding to the length L''' is

$$d_t = \sqrt{\frac{3l\,(L'''-l)}{8}} \qquad (15)$$

If the sag really were as much as d_t then the corresponding tension would be:

$$T'''=l^2w/8d_t \qquad (16)$$

The actual tension will be somewhere between T'' and T''' and the actual sag somewhere between d_t and d''. We next assume a tension somewhat larger than T'''. Suppose we assume a tension T_t, then the sag d'_t corresponding to this tension is

$$d'_t=l^2w/8T_t \qquad (17)$$

The actual length of wire with a sag d'_t will be:

$$L_t=l+8(d'_t)^2/3l \qquad (18)$$

The shortening of the wire due to the decreased tension will be:

$$\lambda'=(T''-T_t)l/EA \qquad (19)$$

where T''=actual tension at minimum temperature and no wind;

T_t=actual tension at a temperature t' and no wind;

E=modulus of elasticity;

A=area in square inches.

$L_t+\lambda'$=length if tension were T''. (20)

If equation (20) gives the same value as finally determined for L'' then d_t is the correct sag at the temperature t', and T_t is the correct value for the tension.

In the method outlined above I first make sure that the tension in the wire will not exceed two-thirds of the elastic limit at the minimum temperature and with maximum wind. I then get the sag at minimum temperature and no wind and then calculate the sag and tension at the desired temperature and with no wind. If the wind were blowing very hard one would not attempt to string wires, and since a low wind velocity does not produce any appreciable tension, what the construction man really wants to know is the sag and tension to be allowed at the temperature at which he is stringing the wires. An excellent method would be to use a dynamometer and adjust the sag for the calculated tension.

Application of the Formulas.

Find the sag in wires at the lowest temperature, say—40 degrees Fahrenheit, and the sag at a temperature of 110 degrees Fahrenheit in a span 600 feet long using No. 0000 hard-drawn bare copper wire.

The diameter of the wire is 0.46 inch, the area 0.166 inch, and the weight per foot 0.64 pounds.

The elastic limit is $0.166\times25{,}000=4{,}150$ pounds. $E=18{,}000{,}000$ and $B=0.0000095$. Assume a wind velocity of 90 miles per hour. Then

$p=.0025\times(90)^2=20.25$ pounds per square foot.

$P=0.055\times20.25\times0.46=0.51$ pounds per lineal foot.

$W=\sqrt{(0.64^2+0.51^2)}$ 0.818 pounds per lineal foot.

$d=600^2\times0.818/8\times4{,}150\times0.667=13.4$ feet.

where d=sag cold with maximum wind; and T is taken as 2,767 pounds or two-thirds the elastic limit of the wire.

$L=600+8\times13.4^2/3\times600=600.80$ feet.

where L=actual length of wire at minimum temperature and maximum wind.

If T actually remained at 2,767 pounds the sag cold and with no wind would be:

$d_1=(0.64/0.818)13.4=10.5$ feet.

But the wire has shortened somewhat due to the decreased tension. If the sag were d (actually lies between d and d_1) the tension T' would be

$T'=600^2\times0.64/8\times13.4=2{,}150$ pounds.

The tension lies between 2,150 pounds and 2,767 pounds. Assume $T''=2{,}300$ pounds; then $T-T''=2{,}767-2{,}300=467$ pounds, and the elastic shortening will be $\lambda=467\times600/18{,}000{,}000\times0.166=0.094$ feet.

The sag d'' corresponding to a tension of 2,300 pounds is

$d''=600\times0.64/8\times2{,}300=12.6$ feet.

$L''=600+8\times12.6^2/1{,}800=600.71$ feet.

$L'+\lambda=600.71+0.094=600.804$ feet.

The length of wire L at minimum temperature and maximum wind was 600.80. Therefore we have chosen almost exactly the right value for T''. The actual sag is 12.6 feet and the actual tension in the wire is 2,300 pounds at —40 degrees Fahrenheit and no wind.

We will next find the sag and tension at 110 degrees Fahrenheit and no wind.

$$L'''=L''[1+B(t'-t)]$$
$$=600.71[1+0.0000095\ (150)]$$
$$=601.563$$

The sag corresponding to the length L''' is

$$d_t=\sqrt{\frac{3\times600\,(601.563-600)}{8}}=18.7 \text{ feet.}$$

But as before the decreased tension shortens the wire somewhat. If the sag were 18.7 feet the tension would be

$T'''=600^2\times0.64/(8\times18.7)=1{,}540$ pounds.

The tension actually lies somewhere between 1,540 and 2,300 pounds. Assume $T_t=1{,}800$ pounds. Then

$\lambda'=(2{,}300-1{,}800)\times600/18{,}000{,}000\times0.166=0.10$ feet.

The sag for a tension of 1,800 pounds is

$d'_t=600^2\times0.64/8\times1{,}800=16$ feet.

$L_t=600+8\times16^2/1{,}800=601.14$.

$L_t+\lambda'=601.14+0.10=601.24$.

This is considerably less than 601.563, therefore the tension is less than 1,800. Assume $T_t=1{,}610$ pounds.

$d'_t=600^2\times0.64/8\times1{,}610=17.9$ feet.

$L_t=600+8\times17.9^2/1{,}800=601.425$ feet.

$\lambda'=(2{,}300-1{,}610)\times600/18{,}000{,}000\times0.166=0.138$ foot.

$L_t+\lambda'=601.425+0.138=601.563$ feet.

This is exactly the value obtained for L''', therefore at 110 degrees Fahrenheit, no wind, the sag is 17.9 feet and the tension is 1,610 pounds.

A study of the above calculations brings out some interesting points. They show that a considerable error will be made if, as some writers say, we neglect the elastic shortening or lengthening due to the variations in the tension. This also probably accounts for the fact that there has been considerable disagreement as to what the value of the linear temperature coefficient is in a wire under tension. Some writers have stated that it is probably only about one-half of 0.0000095. There is no reason why the temperature coefficient of linear expansion should change, except as the wire lengthens or shortens due to variations in the tension, which can be calculated if we know the modulus of elasticity of the wire and the amount that the tension changes.

If the tension in a No. 0000 copper wire would decrease 2,950 pounds, the wire would shorten as much due to this decreased tension as it would lengthen due to an increase of 100 degrees Fahrenheit in the temperature. Of course this could not actually occur in practice as the wire would have to lengthen and let the sag increase before the tension could decrease. However, quite a large percentage of the lengthening of the wire due to increased temperature may be offset by the elastic shortening due to the decreased tension.

On account of the lower tensile strength and the much higher coefficient of linear expansion due to temperature variations of aluminium wire, it is very important that the above calculations be very carefully and accurately made when considering long spans and aluminium conductors.

Membership Campaign of New York Electrical Society.

During the present season the New York Electrical Society has already billed several meetings of interest, while its plans for the new year are of quite an ambitious character. As may be expected under the presidency of so progressive a man as H. L. Doherty, the affairs of the Society are taking on a new aspect, especially as Mr. Doherty has insisted on the necessity of a progressive membership campaign. Such a campaign, however, always necessitates funds for its prosecution, and President Doherty and Willard E. Case, of Auburn, N. Y., who as a member of old standing and as a former vice-president has taken the deepest interest in the work of the Society, have contributed conjointly a large sum of money to enable these plans to be carried out. G. H. Guy, secretary, has taken up this work with wonted energy, and it is believed that as a result of this effort the membership of the Society, now about 700, can be pushed to the thousand mark. Details as to the campaign will be announced shortly.

New Electrical and Mechanical Appliances

Pole-Top Disconnecting Switches.

Pole-top switches are an essential feature of every well designed transmission system and are coming into more general use as the sole switch equipment of the high-voltage side of outdoor substations. Such switches should be made so as to open all poles at once from the ground in order to insure the safety of the operator. They can be obtained in single, double, triple or four-pole types of either the single or double-break feature per pole, as well as the combination of these features for service in connection with fuses.

A single pole of a 30,000-volt, 150-ampere, pole-top switch of the double-break type is shown in Fig. 1. The contacts are of the flexible, self-aligning type. The switch is furnished so that it can be locked in either the open or closed position as desired. This style of switch, when equipped with discharging horns, has been found capable of interrupting loads of considerable value.

A triple-pole, 22,000-volt, 100-ampere, pole-top switch of the single-break type is shown in Fig. 2. This style of switch can readily be mounted either vertically or horizontally, the control handle adapting itself to either

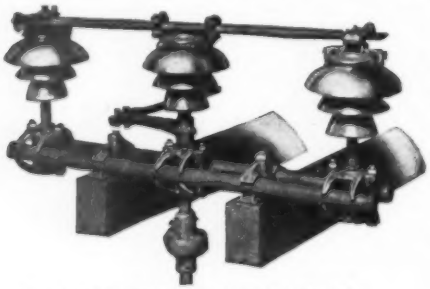


Fig. 1.—One Pole of 30,000-Volt Switch.

mounting, as well as at either the center or the end of the switch as desired.

The switch as illustrated in Fig. 2 is not equipped with fuse tubes or fittings, but can be so furnished if required.

In Fig. 3 is shown a triple-pole, 15,000-volt, 100-ampere combined switch and fuse, the usual switch blade in this type being supplanted by a hickory tube boiled in linseed oil, dried and then varnished. The hickory tube contains the fuse, which is readily renewable. The switch and control handle can be mounted in a similar manner to that described above.

All three of these types of pole-top switches have been so designed that the work required for installing them is of the simplest and most elementary nature, consisting of bolting the switch units, which are shipped completely assembled, to the arms and attaching the control.

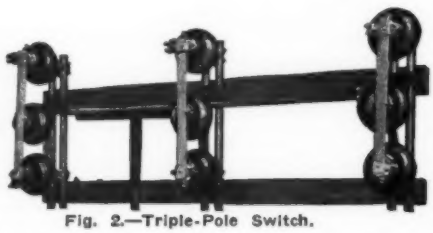


Fig. 2.—Triple-Pole Switch.

The switches are built with clamped pipe arms and are capable of adjustment in every way, thus affording a rigid construction readily adaptable to standard pole-line framing. It is only necessary for the user to furnish the required pole and cross-arm work.

Of the many uses to which switches of the type described above have been put, the most usual are: opening branch lines, disconnecting transformer banks, diverting energy past substations, disconnecting portable substations from high-tension lines of electric railways, and as line sectionalizing switches.

These switches are manufactured by the Electrical Engineers Equipment Company, 10 North Desplaines Street, Chicago, Ill.

A New Method of Street Lighting in England.

Although in Great Britain there is not such enthusiasm over spectacular illuminatory displays as in the United States, a considerable amount of investigation has taken place with regard to the application of science to the art of illumination and in connection therewith there have been from time to time some very interesting displays. It is the purpose of this note to draw attention to what may be regarded as the latest development, so far as Great Britain is concerned, in the problem of street lighting and it is all the more interesting because it has a very practical bearing upon the illumination of main thoroughfares.

Before the advent of the metal-filament lamp the public lighting of main streets was always associated with the arc lamp, but since that time considerable experience has been developed in connection with the single-lamp and cluster fittings. This experience has been all to the benefit of scientific illumination and a great impetus has been given to electric street lighting because of its innovation. The arc lamp even in its simplest form is distinctly more expensive than the tungsten cluster, and much more than the single metal lamp and fitting, while the possibility of subdividing the lighting into smaller units makes for a more uniform illumination along the roadway. Moreover, the metal lamp is not so heavy as the arc lamp and its gear, and hence a lighter form of suspension is possible, involving an easier method of construction.

The Barrow suspension device, made by the Wardle Engineering Company, Limited, of Manchester, England, is typical of the latest progress in the use of metal-filament fixtures for street lighting, inasmuch as it provides a means of

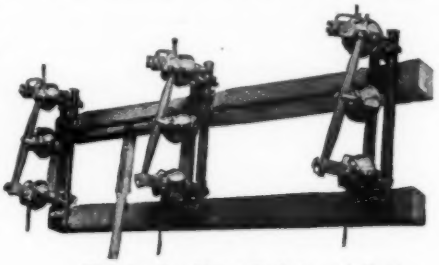


Fig. 3.—Combined Switch and Fuse.

open-air lighting with a large number of small units instead of a small number of large units. The advantages are obvious, inasmuch as the evenness of distribution, the absence of patches and shadows are of the greatest importance in these days of fast vehicular traffic. The fittings to be described were designed primarily for the lighting of railway routes where span-wire construction was in use, but it may be pointed out that it is not dependent on trolley wires, as the device can be suspended from two wires attached to

buildings on either side of the road. After numerous experiments they were adopted by the Barrow Corporation for lighting one of the main roads into that town, and as the district was a residential one, the road was entirely dependent on these lamps for illumination.

The illustration shows the type of suspension adopted. The road in question has a total width of 80 feet, consisting of a 40-foot carriage way and two footways of 20 feet each. Trees are planted along each footway about 3 feet 6 inches from the curbs, the foliage of these effectually obscuring a large proportion of the light from the gas lamps which had been before used. A seven-sixteenth inch galvanized-steel suspension wire was fixed across the road between each pair of poles and from these were suspended two fittings, each fitting being fixed 13.5 feet from the center of the road. These fittings are 6.25 feet in length overall, and bring the lamp to a height of 17.5 feet from the road level. The stems of the fittings are passed through reel insulators which are attached to the trolley span wire, thus preventing the fittings from swinging, and at the same time leaving them free to move vertically. The fittings are fixed to the suspension wire by means of binders similar to those used by the British Post Office authorities for fixing overhead wires to insulators. These binders are also used for fitting the insulators to the span wires so that the erection of a fitting only occupies a few minutes. The lanterns employed have 18-inch fittings, in each of which there is one 60-watt tungsten lamp, although allowance has been made in the wiring scheme for replacing these by 100-watt lamps should it be found advisable to increase the illumination. The total weight of each fitting complete with its lantern is approximately 17 pounds.

In order to connect the overhead system to the mains, a small three-way fuse board in a cast-iron case is fixed to each pole along one side of the road, about five feet from the ground, and from the outlet to these is taken a three-core cable running up the inside of the pole. It passes along the suspension wire to the first fitting, from which two-core cable is taken to the fitting on the other side of the road. The cables are fixed to the suspension wire by means of two-part porcelain insulators spaced about three feet apart. The connection from the main to each pair of lamps is made by means of three-core paper-insulated and lead-covered cable drawn into one-inch galvanized pipe which passes through the base of the pole. The cable passes up the pole and is taken into the bottom of the three-way fuse board, which is provided with a suitable sealing chamber. As the main is laid on the building side of the footway, about 21 feet of cable is required for each service.

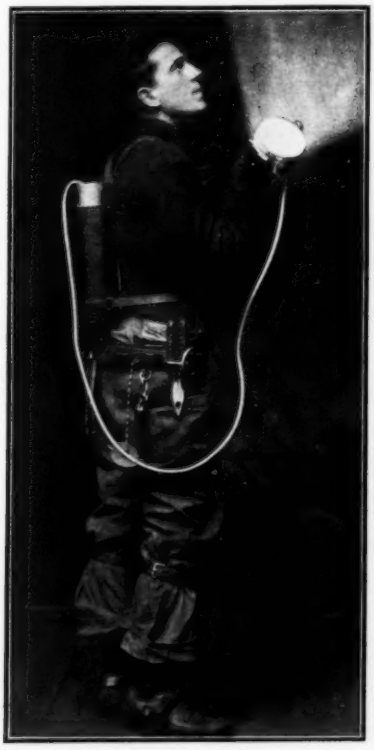
Street Lighting, Barrow-in-Furness.

A Trouble Man's Portable Searchlight.

Line troubles on overhead lines occur very commonly at night when the difficulty and danger of making repairs is greatest. On many lines repairs must be made immediately, however, in order to make interruptions of service of minimum duration. The difficulty of detecting a crossed or broken wire by means of only an ordinary hand lantern is so great that it has called forth the invention of a powerful searchlight which has been developed by experienced trouble men in the city of Marion, Ind.

The outfit consists of a powerful but handy acetylene lamp connected by a strong flexible rubber tube to a gas tank or gas generator that is mounted in a leather case fitted with straps for fastening on a man's back. The lamp has a parabolic reflector that throws a concentrated beam of light, making it possible to distinguish objects plainly at a distance of 75 to 100 feet. The lamp has two handles, one at the top for carrying and one at the back to facilitate directing the light in any direction. The gas tank is a nickel-plated steel holder with a small gauge on the bottom to show the amount of gas available. The tank can be readily recharged at any garage and holds sufficient compressed acetylene gas to burn continuously for about 65 hours. If it is not desired to use compressed gas, an effective gas generator can be provided in place of the gas tank.

With the aid of this searchlight it is possible to see clearly the wires at the top of the tallest poles. When the man has located a source of trouble he places the lamp outfit on the ground and can work on the lines unimpeded. The lamp furnishes sufficient light for the refusing of transformers or the replacing and repairing of any overhead wires, insulators, crossarms, etc. Repairs are therefore very quickly made at night and with almost as little danger from high-tension sources as during the day.



Trouble Man's Portable Searchlight.

The portable searchlight described has been successfully used by electric light and power, electric railway, telephone and telegraph companies and fire-alarm departments of cities. It has been placed on the market by the Electric City Sales Company, 114 West Fourth Street, Marion, Ind.

The U. S. L. Electric Self-Starter and Lighter.

As the result of its long and extensive experience in the manufacture of automatic equipment for the electric lighting of railroad cars, the United States Light & Heating Company, 30 Church Street, New York City, has developed a complete automatic electrical system for gasoline automobiles which furnishes a reliable and abundant supply of electrical energy for the self-starting of the engine, for ignition, for the complete lighting of the car, for electric horns, special decorations, signs and other electrical needs.

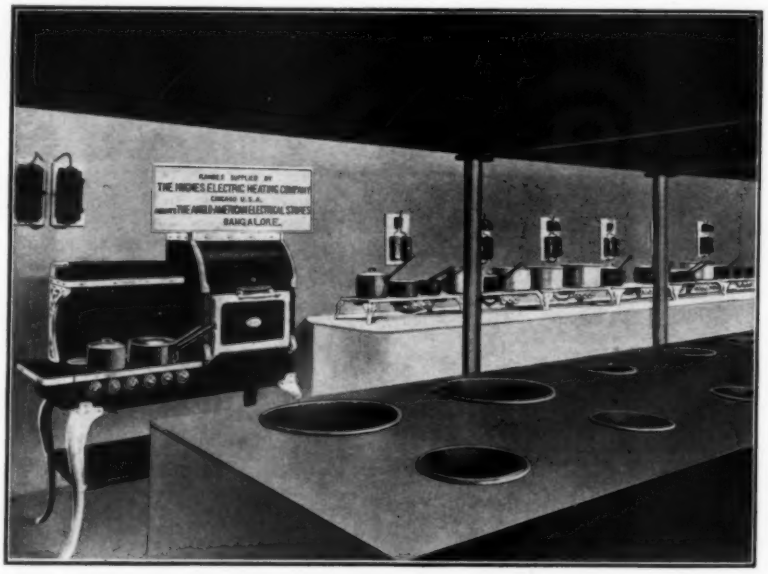
This system includes a dynamo applied in place of the usual engine fly-wheel, a small storage battery, automatic regulators of the dynamo voltage and battery charge, and automatic switches with push-button control. The dynamo acts as the source of all the electrical energy used and supplies it directly except when the engine is standing still or starting; when the engine is running at fair speed, it not only supplies the current needed for ignition, lighting, etc., but also charges the battery automatically. The battery used is of much smaller capacity than ordinarily required, since it is kept well charged (but not overcharged) at all times. It supplies the lighting current when the engine is standing still and the ignition and starting current when the engine is started.

The electric starting of the engine is accomplished in a very simple but positive manner. By merely pressing the starting button the dynamo is connected to the battery which operates it as a motor to turn over the engine and thus entirely do away with hand cranking and its numerous inconveniences and dangers. As soon as the engine starts the motor is automatically reconverted into a dynamo and immediately assumes its load, relieving the battery and presently charging it again. The current taken in starting is small and it has been found that the engine can be started over 200 times in an hour without appreciably discharging the battery.

In a practical test conducted for over two years the device has started an engine over 300,000 times, under every conceivable condition that is met with by the most ignorant driver. It was then found to be in such condition that no material deterioration in the battery was evident and no repairs whatever were required, the battery being in first-class condition for several years more of constant use. This is due to the fact that the battery is charged and discharged at a low rate and kept always in perfect condition. The system is, in all respects, free from complicated features and there are no bearings or other moving parts added to the car. No adjustments or special care is required, since the regulators and all the apparatus are substantially built and carefully adjusted while under construction and test at the factory.

Electrical Kitchen Equipment for a Prince of India.

That one of the native rulers of India is thoroughly up-to-date is shown by the accompanying illustration of the electrical cooking equipment in the kitchen of the imposing palace of the Maharajah of Mysore. Comprised in the installation are six three-burner hot plates, four two-burner hot plates, one four-burner range with elevated oven and warming closet, two table stoves, and six self-contained ovens. In the foreground of the picture can be seen the holes in the top of the old charcoal stove formerly used. This was very slow in its operation and greatly heated the room, making it very oppressive in the already hot climate of the region. The electrical equipment is proving very satisfactory; it is used regularly, providing food on festival occasions for as many as 130 guests. C. F. Eames, chief electrical engineer of the Mysore Government, superintendented the installation. The equipment was furnished by an American firm, the Hughes Electric Heating Company, 211 West Schiller Street, Chicago, Ill.



Electrical Kitchen Equipment in an Indian Palace.

Colorado Coal Production.

Despite the fact that the coal-mining operations were handicapped in several ways during 1912, the output from the 162 active mines in Colorado amounted to 10,943,153 tons, or an increase of 815,588 tons over 1911, when the total coal mined amounted to 10,127,595 tons.

The tons of lignite coal produced were 1,929,854; bituminous 7,959,466; semi-bituminous 923,288; anthracite 60,545.

Production of Tungsten Ore in 1912.

The quantity of tungsten ore mined and marketed in the United States during 1912, according to preliminary figures collected by Frank L. Hess, of the United States Geological Survey, was equivalent to about 1,290 tons carrying 60 per cent of tungsten trioxide and was valued at $492,000. This is an increase over the output of 1911, which was valued at $407,985.

As usual, the largest production from any single district was made from the unique ferberite deposits of Boulder County, Colo. About 1,200 tons of ore of various grades were shipped out, equivalent to 775 tons of 60 per cent ore.

In California the Atolia Mining Company, which controls the Atolia field, at the north edge of San Bernardino County, increased the production of its remarkably pure scheelite over that of 1911 and was the largest individual producer in the United States.

In Arizona a few tons of hübnerite concentrates were shipped from the dry placers and some ore from the veins near Dragoon; hübnerite ore was shipped from Arivaca to Denver for concentration; and some scheelite concentrates were shipped from Oracle, where scheelite is associated with gold and silver ores.

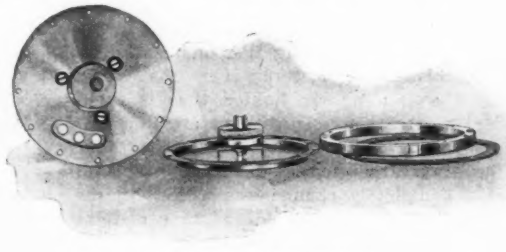
There are said to be 100,000 amateur wireless stations in the United States, of which 40,000 are equipped for sending, the remainder consisting merely of receiving apparatus.

The Gottschalk Telephone Transmitter.

The accompanying illustrations show an improved telephone transmitter, the invention of Felix Gottschalk, of New York City, which possesses many original and valuable features.

The sound-receiving diaphragm is pan-shaped in form, the vibrating surface being similar to that of a drum head. The material used is phosphor bronze, which unlike the ordinary aluminum transmitter is non-corrosive. This diaphragm is clamped tightly at its periphery, and by virtue of its construction and the manner of attaching to the cell no damping springs or other devices are necessary.

Gottschalk Transmitter Complete.



Transmitter Disassembled.

View Without Guard.

It is now well established by physicists that the point of greatest vibration in a diaphragm is at a point midway between the center and the periphery, and advantage is taken of this by connecting the resistance cell to the diaphragm by means of a spidershaped member which is soldered to the inner surface of the diaphragm at several points. This results in a greatly increased agitation of the granules and a corresponding increase in the variations in the electrical circuit and a constant increase in the transmission. This spider member eliminates the use of damping springs, which are bound to impede the vibrations of the diaphragm.

Modern requirements, such as found in railway, mine and other telephone work where the instruments are exposed to the weather, necessitate an instrument which is not only of high transmitting power, but of absolutely water-tight construction. The Gottschalk instrument is perhaps the first one to come into commercial use which is water-tight. Heretofore attempts have been made to produce moisture-proof transmitters, but if these were soaked in rain or immersed in water, which often occurs in transmitters on shipboard where instruments are located in boxes on deck are often filled by the splash of the waves, the water will penetrate to them. This does no harm to the Gottschalk transmitter, which may be immersed for days in water without injury.

The casing proper carries two insulated terminals which are connected to the cell in such a manner that the electrical circuit is confined entirely thereto and is not connected to the diaphragm or casing. This eliminates all electrolytic corrosion.

Owing to the increased sensibility of the instrument, the usual funnel-shaped mouthpiece, which is necessary in the ordinary transmitter to intensify the sound waves, is eliminated and its place taken by a flat perforated metallic guard. The gain in the use of this from a sanitary standpoint is enormous as it is readily wiped clean, there is no necessity to place the lips in contact with it to gain satisfactory transmission, and the instrument may be bathed in a germicide solution, thereby making it absolutely sterile.

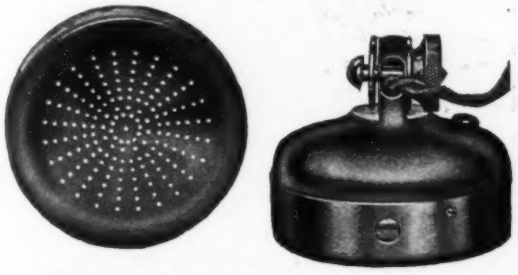
Diaphragm Cell.

The filthiness of the ordinary mouthpiece is but little recognized by the layman. As a matter of fact, it is a more deadly menace in booth pay stations and other public places than is the public drinking cup, which is at least washed out occasionally by the user, who certainly does not attempt to wash out the telephone. The generally awakened sentiment of the people towards rendering sanitary anything used by the public will soon demand a truly sanitary telephone.

From the illustrations herewith, the simple construction and few parts of the instrument are evident. As there is no interior air space, change in adjustment due to changes in atmospheric density are eliminated, and as the instrument is water-proof, nothing can affect the cell.

While apparently simple in construction, the instrument is covered by some 15 United States and many foreign patents. It was found to be quite a problem to design a casing that would be simple, efficient, and yet waterproof, to say nothing of the difficulty in designing a transmitter that would of itself possess the inherent features necessary to take advantage of the latest discoveries in diaphragm vibration.

The instrument has been placed on the market and is now being tried out by several of the large operating companies. From the result of tests made in several university laboratories and by H. R. Van Deventer, the well known telephone engineer, in his transmission laboratory, the instrument is found to be from five to seven miles better in terms of standard cable, than types using the ordinary form of diaphragm.



Views Showing Guard and Drain Hole in Lower Edge.

Rear View, Showing Terminals.

Electrically Driven Drop Hammers.

The steam hammer was one of the great triumphs of the nineteenth century; and in some works the prospect of abandoning steam altogether for electricity seems to imply the sacrifice of a necessary part of the plant. But the electrically driven pneumatic hammer provides a handy substitute in a large number of the everyday cases for which steam would have to be employed; and the friction drop stamp is available for die work in factories where no steam supply is at hand.

MODERN SHOW-CASE LIGHTING.

By William S. Kilmer.

It seems to be the prevailing practice of many merchants to flood the exterior show windows with light, and put little thought, if any, to a proper system of show-case lighting. It is quite true that, prior to the last few years, the methods available for this purpose were very meager and unsatisfactory.

The show-case problem is big, one of the biggest of the entire store equipment. The average metropolitan department store has 3,000 feet of aisle and wall cases, while the frontage for show windows will not average more than 300 feet, or 10 per cent of the show-case equipment.

The merchant dresses and lights his windows to attract the interested and disinterested public. As an advertising medium, it ranks even with the newspaper. When reputation, show windows and advertising have done their work, the store is full of the great buying public. The more merchandise that can be shown in a short space of time, the greater the sales. A customer may come to the store for a paper of pins; a well lighted leather or lingerie-goods case attracts, and the sale increases by $2 to $5. Another feature is that well lighted goods sell more rapidly without handling, since a closer selection is made possible without removing them from the case, and it stands to reason that, if a piece of merchandise is shown in its true color and perspective, it will look the same when removed from the case. Thousands of dollars are lost by the continual handling of delicate and perishable goods unnecessarily, and many a first installation cost of a show-case lighting system is saved by this single feature. On the other hand, a poorly lighted case is often worse than one without any form of artificial lighting, because the light rays are often of such a color as to completely change the color of the goods, and a poor distribution of light may entirely alter the form.

Fig. 1.—Linolite Lamp for Show-Case Lighting.

Fig. 2.—Section Through Show-Case Reflector.

In selecting any form of a show-case lighting system, the following vital points must be considered by the progressive merchant:

First, the system must give an illumination in the interior of the case which is approximately double that of the general illumination of the store interior.

Second, the light must be of such a quantity and quality that the goods are shown in their true color and form.

Third, the interior temperature of the case must not be raised to any appreciable extent, and any increase, however small, must be evenly distributed, as a glass case which is warm in spots is very liable to crack with the first cold draft which strikes the exterior.

Fourth, the unit of light must be neat and inconspicuous, and permit an easy and thorough cleaning of the case.

Fifth, general efficiency must be taken into consideration.

A lamp which meets this condition to a remarkable degree of accuracy is the long tubular lamp shown in Fig. 1, and known as the Linolite lamp. This lamp is approximately one foot long and one inch in diameter. The tungsten filament runs parallel to the tube through the entire length of the lamp, the current passing through from end to end. The interior glass area of this lamp is 31 square inches against 17 square inches of the ordinary "bunghole" type, and 24 square inches of the ordinary bulb lamp of the same wattage. This large glass area insures low temperature, and long life, and on account of its peculiar shape, it adapts itself to a very small reflector.

Fig. 2 illustrates a show-case reflector 2.5 inches deep and 2 inches high. It is scientifically designed and throws

Fig. 3.—Lighting of Perfume Cases.

Fig. 4.—Glass and Silverware Cases.

Fig. 5.—Cases in Corset Department.

Fig. 6.—Lighting of Marble Statuary Colonade.

a powerful and correct distribution of light. The following views were all prepared by time exposures, and show the practical application of over 3,000 feet of this system in the new palatial store of Lipman, Wolfe & Company, Portland, Ore.

Fig. 3 shows the perfume cases surrounding the $20,000 Italian marble and bronze staircase leading from the first floor to the balcony. These cases are 18 inches deep and 3 feet high with glass doors for the front and rear. All these cases are finished in Circassian walnut. Four 25-watt J-M Linolite lamps are used in each case. In the corner aisle cases on the main floor, which are 30 inches deep and 38 inches high, the even illumination over small irregular merchandise is very noticeable. Four 25-watt J-M Linolite lamps are used for every eight feet of frontage. This method is also followed for the display cases and shelving in the rear of the aisle case.

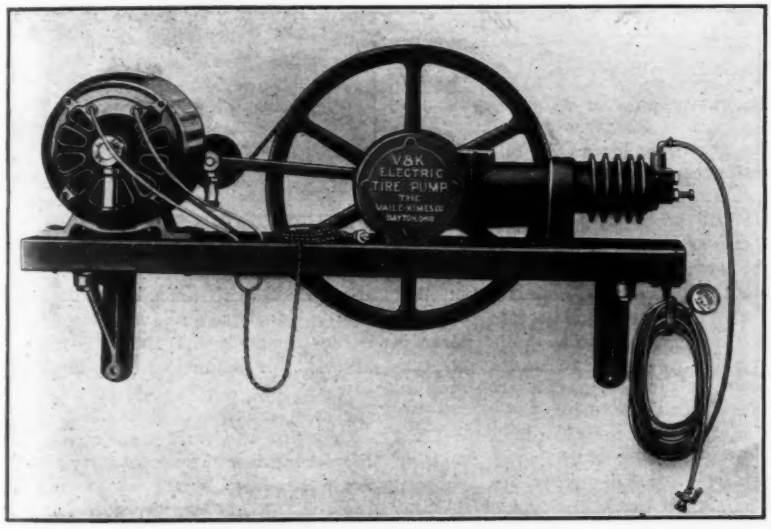
Fig. 4 illustrates aisle and wall cases in the jewelry department displaying glass and silverware. The reflectors in these cases are finished in statuary bronze. The wall cases are three feet deep and five feet high, with two plate-glass shelves. All cases have mirror backs, the exterior finish being Circassian walnut. It will be noted that there is no back reflection from the mirrors. This photograph also shows an interior view of the show-window lighting system. The reflector used in the show windows is a Frink trough reflector. It is finished in white, corresponding with the rest of the window. All reflection of light as well as the source of light is out of the field of vision from both the interior and exterior of the store.

Fig. 5 shows aisle and wall cases in the corset department. The aisle cases are 30 inches deep and 32 inches high, finished in mahogany and have four J-M Linolite lamps per eight feet of frontage. The wall cases are 2 feet deep and 3 feet wide, with three Linolite lamps to each case.

Fig. 6 is a view on the sixth floor, in the art department; this particular section is known as the "Colonnade." The display shelving is built of Philippine mahogany; from the posts to the back the cases are 3 feet 6 inches deep, and from the ceiling to the counter 5 feet 6 inches. The 35-watt J-M Linolite lamp is used here in a special design of Frink wall-case reflector.

An Electric Motor-Driven Tire Pump.

Automobile tire pumps driven by small electric motors are becoming increasingly popular both in public and private garages. It is a keen pleasure to an automobile owner to see his tires filled in a few minutes without effort on his part or material expense, for pumping by hand is surely hard and tiresome work.



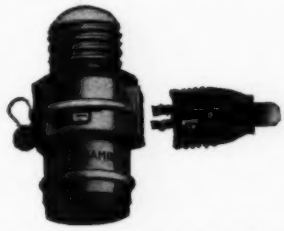
Electrically Driven Tire Pump.

The Vaile-Kimes Company, Dayton, Ohio, has recently placed on the market a new form of tire pump for use in private garages, which is operated by a Westinghouse small motor. This outfit is light, compact, and is designed for mounting on the wall entirely out of the way. Considering the amount of hard work this pump can save, its low cost of operation is suprising, since at ordinary rates for electricity it will operate for less than one cent an hour. The cost of filling a tire is, therefore, insignificant. The operating parts of the pump are inclosed in an oil-tight, dust-proof casing, so that practically no attention is required. A pressure gauge registering up to 150 pounds is provided as part of the outfit. The automobile owner is thus able to maintain his tires at the proper pressure, which adds greatly to their life. It is impossible for oil to get into the tire through this pump, so that rotting from this cause is prevented.

Benjamin Plug Current Tap With Switch.

The rapidly increasing popularity of electrical devices, particularly for use in the home, has called for a more convenient means of connecting these to the lighting circuit than the common method of removing a lamp from a socket to put in the attachment plug connected with the device. Moreover, where there is but a single outlet in a room the removal of the lamp from that outlet may mean leaving the room in darkness. This need has brought forth various forms of current taps which are inserted between the lamps and the original sockets. In these, however, there has heretofore been no means of controlling the lamp independently of the branch circuit.

To meet this further need the Benjamin Electric Manufacturing Company, Chicago, Ill., has placed on the market a current tap with plug connection for the branch circuit and switch for the lamp. As shown in the illustration, this device has a swivel



Plug Current Tap With Switch.

screw shell which permits attaching it to the original socket without turning the entire device and also permits the latter to be adjusted to the same direction that the cord is to run. The lamp that screws into the under side of the device can be independently controlled by a compact lever switch with a quick snap movement; this is shown at the left in the "off" position and dotted in the "on" position. The branch circuit is connected through a very simple little plug shown partly in section at the right. The terminal connecting screws in this are protected in a hard-rubber shell and bushing secured by a brass screw shell. The latter and the brass covers for the porcelain parts of the main body can be finished to correspond with the fixture. This feature, together with the compactness of the entire design, makes the device unobtrusive. The prongs of the plug are readily inserted in the receptacle of the device and held so they do not loosen from vibration or shock.

This current tap is particularly suitable for the quick and convenient attachment of portable appliances, such as electric curling irons, shaving mugs, heating pads, fans, sewing-machine motors, etc. In the bathroom, boudoir and bedroom they are especially serviceable in permitting the use of these appliances without disturbing the single lamp so commonly provided. At the same time the lever switch makes it convenient to shut off the lamp when the appliance is to be connected during the day.

Although the multiple form of this current tap, known as No. 96, is mostly in demand, a series form, No. 96½, is also made for use with any devices for which the lamp is desired to be connected in series as a resistance. In this form the lever switch is arranged so it may short-circuit the plug connection and leave the lamp burning at full voltage. In both the multiple and series forms all the porcelain parts of the body are covered to protect them from breakage and for the sake of finish, as already referred to. A bead on the lower shell permits transfer of the shade-holder so that the shade maintains its proper relation to the lamp.

Frog's Leg Method of Detecting Wireless Waves.

Inventors have been trying for some time past to find a suitable method for recording wireless messages, especially in the case of long-distance transmission, where the detector and telephone are commonly used to show the presence of waves possessing only a very small amount of energy. Experiments of an interesting nature have recently been carried on by Dr. Lefeuvre, who is professor of physiology at the Medical College of Rennes University in France. He shows that the muscular contraction of a frog's leg can be used not only to detect the waves, but even to make a permanent record of these upon a revolving drum. Owing to the fact that the animal specimens cannot be preserved for a very long time, his method is not likely to be used in practice, but it is at least a very remarkable one from a scientific standpoint.

A small wireless-telegraphy post has been erected at the University in order to receive the time signals or others which are sent out from the Eiffel Tower station at Paris, the distance between these two points being some 180 miles. The method of mounting is shown in the diagram, Fig. 1, which contains an antenna *A*, tuning coil *S*, detector *D*, two 4,000-ohm telephones *T*, *T*, and a potentiometer *P* with battery. Wires are led off from the ends of the telephone circuit so as to connect with a nerve of the frog's leg at *N*. The contraction of the muscle *M* causes the movement of the lever *L* so as to produce a record on a cylinder covered with smoked paper provided for the purpose.

Dr. Lefeuvre finds it preferable to use the entire animal in these experiments, and it is held down upon a suitable base as Fig. 2 shows. A small portion of the sciatic nerve is laid bare and two wires carrying the current are applied at this point. The end of the muscle is connected by a fine wire to

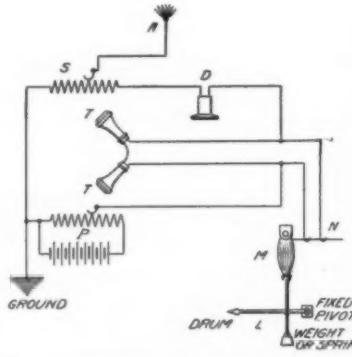


Fig. 1.—Diagram of Frog's Leg Method.

the recording lever. As only the central nervous system, or the brain and spinal marrow, is destroyed, the muscle still receives blood from the contractions of the heart and is thus able to act for a longer period. When mounted in this way it is found that even very minute currents can be recorded. The effect on the nerve is produced by the self-induction currents of the telephones, according to the author's statement.

Fig. 3 shows the records of the Eiffel Tower signals which were made in this way. Such signals are sent out each day at 10:45, 10:47, and 10:49 a. m. The exact time signal is represented by a short dot, but this is preceded by a conventional signal of some length in order to call attention to the main signal. Each preparatory signal is different; thus we have four dashes followed by a dot representing the 10:45 point; a dash and two dots repeated three times and then a dot for 10:47; lastly a dash and four dots repeated

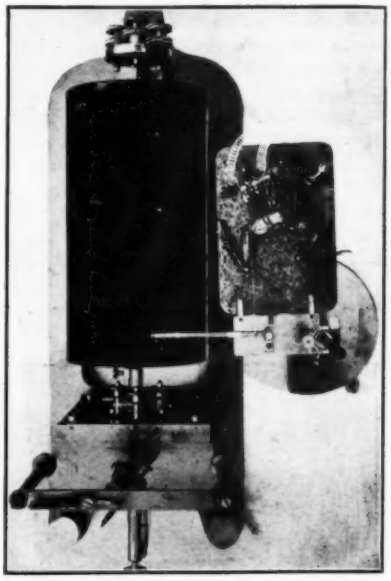


Fig. 2.—View of Apparatus Used.

three times with a final dot for 10:49. These signals are all very clearly recorded on the drum, as the illustration shows. For instance, the top line gives sets of long waves corresponding to the dashes, followed by a sharp wave or dot for the 10:45 time signal. In the second line the preparatory signals are well shown by the waves, and the same is true for the lower line.

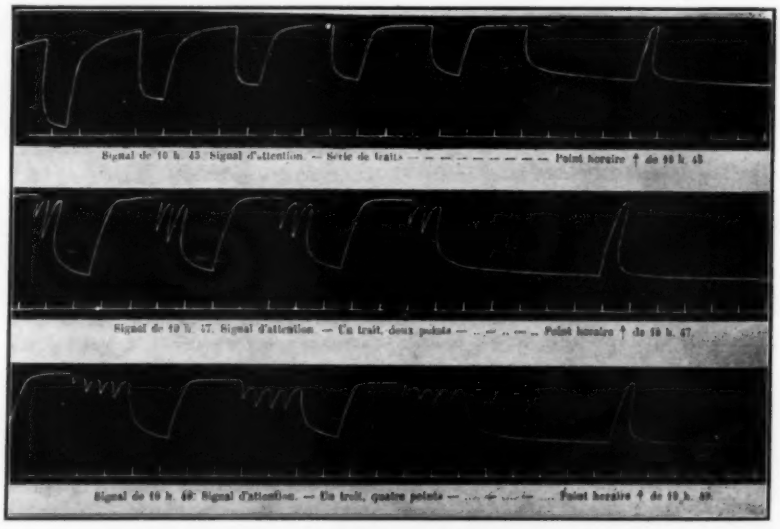


Fig. 3.—Records of Eiffel Tower Wireless Time Signals.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

WINCHESTER, KY.—Plans for a modern street lighting system are in the hands of the City Council of this city. G.

READING, PA.—W. H. Luden, of this city, is going to erect a power plant, which it is estimated will cost $6,000.

HALLS, TENN.—Electrical equipment will be purchased by the Halls Service & Machinery Company in the immediate future. G.

DEMING, N. M.—The Home Plot Company will install 100 electric pumping plants, each plant being capable of irrigating 20 acres. D.

MUSCATINE, IOWA.—Merchants on West Second Street will install an ornamental lighting system between Iowa Avenue and Chestnut Street. Z.

FORTVILLE, IND.—The Town Council has granted a 50-year franchise to the Traction Light & Power Company to furnish light, heat and power in Fortville.

WESTERLY, R. I.—The Westerly Light & Gas Company has decided to extend its electric wires to Montville and supply that village with electric service in the near future.

PANAMA, P. I.—An electric light and power plant is to be erected at Boquette Ranch, and it is reported that similar electric plants will also be installed in the same neighborhood.

WELLS, NEV.—H. H. Crazier and J. H. Crazier have been granted their application to appropriate the waters of Trout Creek for the operation of an electric light and power plant.

MULBERRY, KAN.—Bonds in the amount of $45,000 have been voted by this town for a water and light plant, $30,000 being intended for the electric light plant and the balance for the water works.

HUNTINGTON, IND.—The mayor of this town has recommended the establishment of a municipal lighting plant to supply electricity to the citizens of this place in his annual message to the Common Council.

WASHINGTON, D. C.—The Alexandria Court House Citizens' Association has appointed C. T. Jesse and W. O. Pickett as a committee to have in charge installing lights along the Ballston Road to Rosslyn.

MEMPHIS, TENN.—A project involving the expenditure of $50,000,000 in harnessing the Mississippi River for the generation of hydroelectric power has been set on foot by the Memphis Lumberman's Club. G.

MURRAY, KY.—Theron Wells, superintendent of the Murray Light & Power Company, has announced that his company will replace its present poles and wires with new ones as soon as the weather permits. G.

REDDING, CAL.—The Northern California Power Company, it is reported, will spend $225,000 on improvements and betterments in Shasta County during the coming year, and work will be commenced early in the spring.

FULTON, KY.—About $40,000 is to be spent in the improvement of the plant of the Fulton Light & Power Company. The company was recently purchased for $40,000 by G. K. Mittenberger and his associates, of St. Louis, Mo. G.

MARLIN, TEX.—E. P. Turner, of Dallas, and associates are promoting the construction of an interurban electric railway between Marlin and Temple. The route of the proposed line is through a very populous part of the state. D.

VIRDEN, ILL.—Tucker & Stowell, proprietors of the Virden Electric Light Company, have purchased from the City of Girard the municipal electric light plant, and a 25-year franchise has been granted the new owners by the city. Z.

LEXINGTON, KY.—One of the recommendations of the new City Commissioners constituting a new form of municipal government, is that a modern street lighting system be supplied for the shopping district as soon as possible. G.

LEXINGTON, KY.—The Shelby Fiscal Court, Shelbyville, Ky., has given J. K. Todd, representing the Kentucky Utilities Company, this city, a 20-year franchise allowing it to make line connections along the public roads of Shelby County. G.

GRAND RAPIDS, WIS.—The Centralia Pump & Water Power Company of this city has increased its capital stock from $100,000 to $300,000, and intends to make extensive improvements to its plant, and extend its scope considerably. M.

BRIDGEPORT, O.—The Belmont Electric Company has been incorporated with a capital stock of $10,000 to do a light, heat and power business. The incorporators are J. C. Dent, A. C. Branum, L. W. Heimlein, W. E. Thoma and J. E. Fox.

MUNFORDVILLE, O.—The Munfordville Electric Light & Power Company has been incorporated with a capital stock of $3,500 by P. K. Hubbard, C. D. Dickey, C. C. Winston, J. O. Bright, J. M. Jones, O. F. King, J. G. Adams and E. E. Biggs.

SCOTT CITY, KAN.—This city has voted $40,000 in bonds for a municipal electric light plant and waterworks. In addition to supplying the city with light and water it is the intention to supply power to farmers to pump water for irrigation purposes.

LOUISVILLE, KY.—The Seelbach Hotel Company plans soon to commence the erection of a $50,000 annex to its present power station. This annex will provide ample power for the increased demand exerted by the big hotel upon its present facilities. G.

GLOBE, ARIZ.—The Copper Reef Mining Company will install a new electric power station here and build a transmission line from San Carlos to its mine, a distance of about 12 miles. The company will also install an aerial tramway upon its property here. D.

PADUCAH, KY.—A portion of a $50,000 appropriation asked by the Board of Public Works of this city is to be expended for boulevard lighting standards and their installation in the retail business section. A dynamo will also be purchased for the electric light plant. G.

WOOD RIVER, ILL.—The Madison Light & Power Company has submitted a proposition to the Village Board at Bethalto offering for $500 to run a transmission line from the company's power plant here to Bethalto. A contract for lighting the village streets is asked. Z.

HARRISBURG, PA.—Nine charters were granted to electric companies to operate in Northampton County and vicinity, the capital of each being $5,600 and the office at Nazareth. They are Huron, Seminole, Tecumseh, Iroquois, Secaucus, Seneca, Powhatan, Onandago, and Mohican. N.

WENATCHEE, WASH.—Promoters have already taken steps toward securing sites on the Icicle Creek, above Leavenworth, to be used for generating power sufficient to provide the Wenatchee Valley for all future needs. The project will involve an expenditure of several thousands of dollars by this city.

WINCHESTER, TENN.—A franchise to supply Decherd with electricity has been secured by the Stone Power Company, which will supply its station at Winchester with two 26-inch water wheels of 180 horsepower capacity, and a 180-kilowatt, 60-cycle alternating-current generator in the near future. G.

BELVIDERE, ILL.—The Illinois Northern Utilities Company will erect a mammoth power plant on the Kishwaukee River at this place. The plans understood to be in contemplation include a big power house with capacity sufficient to furnish light and energy over a considerable scope of country if necessary.

RENO, NEV.—The Nevada Valley Power Company has filed a trust deed of its entire holdings to the International Trust Company, of Denver, as a first step toward the construction of a huge power plant designed to supply light and power to all portions of the state. The plant is to be located about 20 miles east of this city on the Truckee River.

PHILADELPHIA, PA.—Charters have been granted to the Williams Township Electric Company to operate

in Northampton County and Little Lehigh Electric Company to operate in Longswamp Township, Berks County; Muncy Creek and Clinton Township Electric Companies, Montgomery, to operate in Lycoming County, each with a capital of $5,000. N.

SALT LAKE CITY, UTAH—It is said that the new big power company of Utah is behind a plan which is under way for building a power line which is to run from a point on the Bear River, near Soda Springs, to Salt Lake City. There is some talk of constructing an electric road from Idaho to Ogden.

SMITHVILLE, TEX.—The Ten Thousand Club, of Smithville, is giving its aid to a movement which has for its purpose the organizing of a company to construct an interurban electric railway between Smithville and Austin and between Smithville and Rockport. It is proposed to construct more than 150 miles of track.

MEMPHIS, TENN.—Northern capitalists represented by Stanley H. Trezevant and George H. Alban have made a proposition to the Board of City Commissioners to install a modern electric light and power plant in this city. A 50-year franchise is asked and low rates are promised. It is not thought here, however, that this project will interfere with the passage of the bond issue for the establishment of a municipal plant.

EAGLE PASS, TEX.—The Texas Light & Power Company, which recently purchased the local electric light and waterworks plants at Eagle Pass, will enlarge the electric power station here and construct a transmission line to the Indio ranch, 45 miles, where power will be used to operate pumps for irrigating 6,000 acres of land. The company is also making plans to build other power-transmission lines for the purpose of operating irrigation pumping plants and to furnish light and power for the towns of Cometa and Carrizo Springs.

HARRISBURG, PA.—Hundreds of thousands of dollars in operating expenses are expected to be saved by the merger of gas and electric companies from the northern end of this state. By combining the service of all of these companies in one big power and light plant at Mahanoy City light, heat and power can be furnished to Mahanoy City, Shenendoah and surrounding townships at a vastly lower ratio of expense. The population to be served will be extended from Butler township on the west to Union township on the east. Charters for covering this new territory were recently secured by E. F. Jarvis, Valentine Pfrom, Chester J. Hill, Walter Deitrick and Seth W. Brown, all well known capitalists. The service extends over coal tracts owned by the Reading and the Lehigh Valley Coal Companies. D. W. Kaercher, local attorney for the latter company, represents the new companies, which are believed to have the backing of the coal corporations whose lands they will traverse. The companies merged in this district come in under the $1,000,000 charter of the Schuylkill Gas & Electric Company; those in the Hazleton Electric Company; those in Centre and Clearfield counties under the State-Centre Electric Company, Clearfield, capital $95,000, and in Indiana into the Clymer Electric Company, Clymer, capital $35,000. N.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

ABERDEEN, WASH.—A telephone line will be built along the North River to connect with the exchange at Aberdeen. C.

SOLEDAD, CAL.—The Mission Rural Telephone Company has been organized to serve residents in the Mission district.

COLLEGE SPRINGS, IOWA.—The Farmers' Mutual Telephone Exchange has filed articles of incorporation with a capital stock of $5,000.

GRAND MARAIS, MINN.—The ordinance granting to F. E. Bell the right to establish a telephone system passed the second reading. C.

APPLETON, WIS.—The local telephone exchanges will be merged and the overhead wires will be replaced by cable work and some underground work. C.

ANOKA, MINN.—The council has petitioned the Northwestern Telephone Exchange Company to rebuild the local exchange, installing a central-energy system. C.

OKLAHOMA CITY, OKLA.—Riverside Telephone Company has been incorporated with a capital stock of $250 by John Woolf, F. E. Schuman and D. J. Kolesch.

COSMOPOLIS, WASH.—North River Telephone Company has been incorporated with a capital stock of $2,500 by McKinley Wilson, J. A. Chambers and others.

HUBBLE, O.—Hubble Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are F. F. Fitzpatrick, S. H. Weaver, B. W. Guvens and Robert Rankin.

LONGVIEW, TEX.—The Long Distance Telephone Company will install a flash-light system in its new exchange here. The lines will be placed underground in the business district.

VIRGINIA, MINN.—City attorneys of several range towns were appointed a committee to draw up a uniform franchise in the matter of the towns granting franchises to the new Range Telephone Company. C.

FORT BAYOU, MISS.—The Fort Bayou Telephone Company has been incorporated with a capital stock of $5,000 by S. E. Spencer, of Ocean Springs; R. M. Spaulding, of Fort Bayou, and Alfred Lewis, of Fort Bayou.

GREENVILLE, N. Y.—Newry Rural Telephone Company, Incorporated, has filed articles of incorporation with a capital stock of $130. The incorporators are E. R. Palmer, L. E. Terbush and Eugene Spaulding, all of this city.

ELK POINT, S. D.—The Farmers' & Merchants' Telephone Company has been incorporated with a capital stock of $160,000. The incorporators are W. J. Brownell, W. S. Funk, of Sioux Falls, and E. Greenleaf, of Akron, Iowa.

PLACERVILLE, CAL.—There are to be improvements made to the telephone system in Placerville. Cables are to be strung in certain sections and it is expected that before long all the wires in town will be replaced by cables.

MILWAUKEE, WIS.—Extensive improvements in its system in Milwaukee are contemplated by the Wisconsin Telephone Company for next year. Just what these will consist of further than that they will tend to give the company greater facilities for caring for its patrons, can not be said at present.

CLIFTON, COLO.—Fruit growers of the Clifton and Palisade sections have made plans for incorporating the Western Slope Independent Telephone company with a capital of $25,000. The company has an exchange here and will extend its lines to Palisade and across to Orchard Mesa without delay. It is planned to enter Grand Junction as soon as a franchise can be obtained.

ESTHERWOOD, LA.—The first rural telephone route running west from Crowley has been launched to run out eight and one-half miles across the Hoyt ranch, running to Estherwood, along the Southern Pacific Railroad. The Cumberland Telephone Company will build a double metallic line to Estherwood and join the line at Estherwood. Hoyt Brothers, P. E. Calls, Walter H. Fleshman and Mrs. E. T. Hoyt are the promoters.

ELECTRIC RAILWAYS.

(Special Correspondence.)

EDMONTON, ALTA.—Ten miles of street-car extensions are to be built this year. C.

ROCHESTER, MINN.—H. E. Hance, Manketo, Minn., proposes to take up the question of a local trolley line here with the Commercial Club.

CEDAR RAPIDS, IOWA.—The Dows, Smith & Reed syndicate contemplates building another interurban into the city. It is rumored it will be from Marengo. C.

TACOMA, WASH.—The Tacoma Railway & Power Company will ask a franchise across the new steel bridge to extend a car line to the industries on the tide flats. C.

YORKVILLE, ILL.—George H. Simpson and Judge Williams are interested in a project to run an electric road from Aurora to Mendota, by way of Yorkville and Oswego.

FERGUS FALLS, MINN.—The company which secured a street-railway franchise last year will build next summer; power from the Big Hoot Lake power project will be used. C.

PITTSBURGH, PA.—The Pittsburgh Subway Company has obtained a franchise from the City Council after a fight of over ten years. The system is to cost $50,000,000.

NEW BERN, S. C.—The officers of the New Bern Ghent Street Railway Company now have under consideration the probability of extending the car line to Polloksville and Trenton, in Jones County.

ELKINS, W. VA.—The Elkins Electric Railway Company will build a line from Roaring Creek Junction to Belington, W. Va., a distance of seven miles. P. B. Bloomfield is general manager at Elkins.

FAIRMONT, W. VA.—At a directors' meeting of the Monongahela Valley Traction Company here a traction line was ordered built connecting Lumberport and Gypsy, a distance of two miles. Work will begin immediately.

CINCINNATI, O.—Mayor Hunt is agitating a municipally owned street-car, gas, electric light and telephone service for this city. The first step will be the issuance of $7,000,000 in bonds

for the construction of a belt-line.

LEWISTON, IDAHO.—A franchise has been granted to F. M. Strum, of Wapeton, S. D., to operate electric traction cars on the streets of this place upon the condition that operation is made by August 1. Engineers will be placed in the field immediately to survey the line to Clarkston.

HENDERSONVILLE, N. C.—C. A. Carlson, of Red Bank, N. J., has purchased the Hendersonville Traction Company's street railway, and will extend it on Main Street. Later it is expected to build a belt line around the lakes. He is also reported to have in contemplation the construction of an interurban from Hendersonville to Asheville, N. C.

FAIRMONT, W. VA.—At a meeting of the directors of the Fairmont & Mannington Railway Company held in this city a survey was ordered with a view to constructing an electric road from Annabelle to Mannington. The busines men of Mannington are urging the movement. Annabelle is a thriving mining town near Worthington. The distance to Mannington is about four and one-half miles.

SYRACUSE, N. Y.—It is reported that John B. Taylor, of Watertown, will combine his efforts with the Beebe trolley syndicate and construct a trolley line from Syracuse to Watertown. The proposed route is through Adams, Lacona, Richland, Parish, Mallory, Hastings and Central Square to Brewerton, and through North Syracuse to the Salt City. A portion of this route was constructed this year by the Beebe syndicate.

PHILADELPHIA, PA.—Plans are being developed for a new trolley line in Schuykill County to connect the Mahanoy Valley through Frackville with the Eastern Pennsylvania Railways Company's lines south of the Broad Mountain at St. Clair. This proposed nine-mile link will unite more than 50 miles of trolley lines operated by the Eastern Pennsylvania Railways Company with 30 miles of road owned by the Schuykill Traction Company north of the mountain, running through the Mahanoy Valley, Shenandoah, Mahanoy City, Girardville and Ashland. The population through which the trolley lines will pass totals over 100,000 north and an equal total south of the Broad Mountain. It is one of the most important projects that has been exploited in the Schuylkill district in years and it is said that an abundance of capital is in sight for its furtherance.

RUGBY, N. D.—A. B. Fox and others of this vicinity and of Brazil, an inland town of Pierce county, have incorporated under the title of the Brazil, Devils Lake & Minneapolis Electric Railway Company, and have purchased the Devils Lake and Chautauqua railway. The company proposes to commence work on the construction of an electric line east and west from Devils Lake, the proposed eastern terminal to be Minneapolis, with Williston as the western objective point. It is not likely that the line will reach either of these cities for at least two years as it is the intention of the company to go slow at first and they will follow the style of the Dan Patch line in Minnesota. The cars will be of the gasoline-electric type such as are used extensively by Eastern concerns. The company will extend the Chautauqua line into the city at Devils Lake and connect with the steam roads besides giving a city service.

PROPOSALS.

WIRING, ETC.—Bids will be opened January 22 by Walter Murray, secretary, Pleasure Driveway and Park District, for electric wiring, plumbing and heating at proposed South Park pavilion. Z.

CARBONS.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until February 4 for furnishing 15,000 arc-lamp carbons, to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 5121.

CABLE.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until February 4, for furnishing 15,000 feet of two-conductor cable, to be delivered at the Navy Yard, Washington, D. C., as per Schedule 5114.

MOTOR TRUCK.—Sealed proposals will be received at the Quartermaster's Department, United States Marine Corps, Washington, D. C., until January 20 for furnishing one motor truck at the marine barracks, Navy Yard, Norfolk, Va. Proposals, etc., may be obtained from the above named office.

ELECTRIC PASSENGER ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until February 3 for the installation complete of an electric passenger elevator in the post office at Sioux Falls, S. D., in accordance with drawing and specification, copies of which may be obtained from the office of the Supervising Architect.

LIGHT FIXTURES.—Sealed proposals will be received at the office of the Assistant Purchasing Officer, Isthmian Canal Commission, 24 State Street, New York, N. Y., until January 22 for furnishing the necessary suspended lights, ceiling lights, suspended fixtures, wall brackets, etc., to equip the new Panama Station building, as per Zone Requisition 6263-A. Further information may be obtained from the Assistant Purchasing Officer.

CABLE.—Sealed proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until January 20 for furnishing under proposal No. 634 1,556 feet cable, type 213; 1,200 feet cable, 150-pair, paper insulated; 5,000 feet phosphor bronze antenna cord; 10,000 feet cable, type 214; 3,000 feet cable, type 308; 10,000 feet cable, type 401, and 2,000 feet cable, type 408; also 30,000 feet wire, outside distributing. For further information address W. L. Clark, captain, disbursing officer, U. S. army.

ELECTRIC CONDUITS AND WIRING, AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until February 17 for the electric conduits and wiring, and interior lighting fixtures of a one-story building for the post office at Bowling Green, O.; and until February 19, of a one-story building for the post office at Topeka, Kan., in accordance with drawings and specifications, copies of which may be obtained from the custodians of the sites or at the discretion of the Supervising Architect.

NEW INCORPORATIONS.

TEMPLE, TEX.—The Temple Electric Company has been incorporated with a capital stock of $4,000. The incorporators are James Ferguson, C. A. Hughes and C. A. Love. Z.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the American Conduit Wiring Machine Company with a capital stock of $250,000, by I. and L. Hirshfeld, G. S. Johnson, F. G. Fox and A. J. Wright.

TIFFIN, O.—The Electrical Equipment Company has been incorporated with a capital stock of $25,000 to deal in electrical apparatus of all kinds. The incorporators are N. Eastman, E. D. Chapman, T. H. Brewer, James F. Loftus and H. A. Henry.

CINCINNATI, O.—The Johnson Electric Supply Company has been incorporated with a capital stock of $10,000 to deal in electrical machinery. The incorporators are William J. McCauley, A. Bart Horton, W. M. Beinhart, W. J. Hermann and Claude W. Johnson.

BROOKLYN, N. Y.—Attix Electrical Engineering Company, Incorporated, has filed articles of incorporation with a capital stock of $20,000. The incorporators are G. Burchard Smith, Frederick Van Note and Tillie Attix, all of Brooklyn.

NEW YORK, N. Y.—Chelsea Operating Company, Incorporated, has been granted articles of incorporation with a capital stock of $10,000. The incorporators are William A. Winter, Henry T. Franklin and William G. Lenz, all of New York City.

CHICAGO, ILL.—The Emergency Electric Manufacturing Company has been incorporated with a capital stock of $2,500 to manufacture and deal in electrical apparatus. The incorporators are Hyman Polonski, Arthur B. McCold and Samuel Come. Z.

CLEVELAND, O. — The Victor Electric & Stamping Company has been incorporated with a capital stock of $10,000 for the purpose of manufacturing all kinds of electrical and novelty goods. The incorporators are Morris Gordreich, Joe Feniger, M. A. Riegler, Ben Feniger and C. A. Cornsweet.

PORT EWAN, N. Y.—Centennial Electric Company, Incorporated, has been granted articles of incorporation with a capital stock of $25,000 for the purpose of manufacturing electrical apparatus. The incorporators are William M. Halstead, Henry Hutchinson and Guy V. Williams, all of New York City.

BROOKLYN, N. Y.—The Automatic Music Company, Incorporated, has filed articles of incorporation with a capital stock of $25,000. The company will deal in electric player pianos and organs. The incorporators are Lina Strauss, Faust De Socio and Abram Ellenhogen, New York, N. Y.

HARRISBURG, PA.—Merger papers have been filed at the State Department, combining eight Lebanon electric companies in a new organization which is operating outside of Lebanon, proper. The eight companies are: West Lebanon, $5,000 capital; Swatara, $25,000; Hebron, $5,000; Palmyra, $20,000; Lebanon, $10,000; Meyerston, $5,000; Mill Creek Township, $5,000, and Jackson Township, $5,000. The new corporation has a capital of $80,000. N.

FINANCIAL NOTES.

The feature of the week in financial circles has been the remarkable change in the demand for gold, the shift from a gold import to a gold export basis having occurred apparently without warning. The lessening of local demand, and the return of large funds from the interior have placed the banks in a strong position to meet this demand. Reports of earnings continue on a good basis, and industrial activity indicates little slackening.

The Lehigh Navigation Electric Company, Philadelphia, Pa., has been announced, with a capitalization of $3,370,000. The following are named as officers: S. D. Warriner, Philadelphia, president; R. H. Wilbur, St. Davids, vice president; H. F. Baker, Philadelphia, secretary and treasurer. Directors: R. Dale Benson, E. Walter Clark, Richard Y. Cook, Samuel Dickson, George H. Frazier, Bayard Henry, C. W. S. Packard, H. P. McKean, J. S. Wertz and S. D. Warriner, of Philadelphia and vicinity, and Erskine Hewitt, New York. S. D. Warriner is now president of the Lehigh Coal & Navigation Company. The companies absorbed were chartered in the last eighteen months and are named as follows: Albion, Beechwood, Blackstone, Diamond of Washington township; East Allen, Eldon, Equitable, of Whitehall township; Excelsior, of Blainfield township; Fearne, Gibson, Greenwood, Hazard, Kent, Lehigh Navigation, Lizard Creek, Lower Mt. Bethel, Lower Nazareth, Lower Saucon, Marshall, Mitchell, Moore township, Nesquehoning, North Whitehall, Oakdale, Orchard, Panther Creek, Primrose, Sharswood, Skidmore, South Whitehall, Standard, of Washington township; Star, Story, Taney, Upper Macungie, Upper Milford, Upper Mt. Bethel and Upper Nazareth.

The J. G. White Engineering Corporation has announced the following directors and officers: Harry Bronner, of Hallgarten & Company; James Brown, of Brown Brothers & Company; F. Q. Brown, of Redmond & Company; Douglas Campbell, of Campbell, Harding & Pratt; Geo. C. Clark, Jr., of Clark, Dodge & Company; Bayard Dominick, Jr., of Dominick & Dominick; A. G. Hodenpyl, of Hodenpyl, Hardy & Company; T. W. Lamont, of J. P. Morgan & Company; Capt. Marion McMillin, of Emerson McMillin & Company; J. H. Pardee, president of the J. G. White Management Corporation; E. N. Potter, of Potter, Choate & Prentice; Frederic H. Reed, vice president J. G. White & Company, Inc.; Chas. H. Sabin, vice president Guaranty Trust Company; Frederic Strauss, of J. & W. Seligman & Company; Moses Taylor, of Kean, Taylor & Company; George H. Walbridge, of Bonbright & Company; E. N. Chilson, and C. E. Bailey. The officers are: J. G. White, chairman finance committee; Gano Dunn, president; E. G. Williams, A. S. Crane, H. A. Lardner, vice presidents; H. S. Collette, secretary, R. B. Marchant, treasurer.

The J. W. White Management Corporation announces as directors Cecil Barret, of Spencer Trask & Company; F. Q. Brown, of Redmond & Company; P. M. Chandler, of Chandler Brothers & Company, Philadelphia; Arthur Coppell, of Maitland, Coppell & Company; Gano Dunn, president the J. G. White Engineering Corporation; George E. Hardy, of Hodenpyl, Hardy & Company; R. G. Hutchins, Jr., vice president National Bank of Commerce; R. L. Montgomery, of Montgomery, Clothier & Tyler, Philadelphia; John T. Pratt, of Campbell, Harding & Pratt; Frederick Strauss, of J. & W. Seligman & Company; H. R. Tobey, of N. W. Halsey & Company, and J. G. White, president J. G. White & Company, Inc. The officers are: J. H. Pardee, president; F. H. Reed and S. L. Selden, vice presidents, T. W. Moffat, secretary and treasurer.

The combination of all the western Bell telephone companies into the Mountain States Telephone & Telegraph Company has resulted in an increase in revenue for the year just closed. The gross receipts for the individual companies during 1911 amounted to $5,901,635.76, while the new corporation showed earnings of $6,830,000, a gain in gross revenue of $928,364.24. As a result of the growth of the telephone companies during the past year the expenditures for maintaining the plant were also materially increased and $3,481,221 were spent for additions to the system while the budget for 1912 called for $4,200,000. In 1912 the Mountain States Telephone Company erected 2,743 miles of poles, making a total of 24,409 miles. On these poles wire or cable equal to 173,150 miles, is strung. Of this amount 33,680 miles were strung last year. In addition to this amount there are 171,560 miles of open wire on poles, a gain of 16,601 miles and of underground cable there are 157,606 miles, 46,361 miles of it being put in in 1912. Altogether there are 362 central offices in the telephone system in Colorado, New Mexico, Wyoming, Montana, Utah, Idaho and Nevada, which states make up what is known as the Mountain States Telephone & Telegraph Company.

At the annual meeting of the United States & Hayti Telegraph & Cable Company directors of the company were re-elected.

The El Paso Electric Company's $500,000 six per cent convertible notes will be due and payable January 15, and all notes not converted into common stock by that date will be paid in full, with the interest on them.

A. B. Leach & Company, New York City, are placing privately $3,000,000 first mortgage five-per-cent bonds from an authorized issue of $5,000,000 of the South Carolina Light, Power & Railways Company. The bonds are dated November 1, 1912, due in 25 years but redeemable at 105 on any interest date.

A $60,000,000 mortgage has been filed by the International Railway Company, of Buffalo, N. Y., in favor of the Bankers Trust Company, of New York, trustee for bondholders, as a part of the reorganization plan of the International Railway Company. Bonds to the amount of $8,176,000 are to be issued at once, it is announced.

The Electric Company of America has declared a distribution from the proceeds of the fund collected on unexchanged American Gas & Electric Company bonds of 30 cents per share, payable February 1 to stock of record January 13.

A mortgage involving $5,000,000 has been filed in the office of the Clerk of Court of Cherokee County, South Carolina. The mortgage was given by the South Carolina Light, Power & Railway Company to the New York Trust Company, and is on the property which has been owned by the Electric Power & Manufacturing Company, in Cherokee and Spartanburg counties, S. C., and Cleveland county, N. C. The first-named company has purchased all the power holdings.

Stockholders of the American Light & Traction Company will vote March 17 on a proposed increase in the authorized common stock from $15,000,000 to $40,000,000. Books of the company, for the special meeting and annual meeting to be held the same day, will be closed from February 25 to March 17. The authorized capital stock at present amounts to $40,000,000, consisting of $25,000,000 six-per-cent cumulative preferred stock and $15,000,000 common stock. There is outstanding about $14,236,200 preferred stock and $11,426,200 common stock.

Chicago Railways Company will retire $498,000 five-per-cent collateral trust notes maturing February 1, probably by selling collateral behind them, consisting of $832,000 series A. consolidated 5s. The notes were issued February 1, 1908, to take care of $500,000 par value North Chicago City Railway Company's first-mortgage bonds. The note issue was $500,000, but $2,000 have been exchanged by holders under a provision permitting exchange for the consolidated 5s. Any of these bonds not necessary for funding the notes will be cancelled by the company.

Stockholders of the United Illuminating Company have voted to authorize the directors to increase the capitalization of the corporation from $2,000,000 to $2,500,000. The outstanding stock issue of the company totals $1,800,000 and the directors wish to increase this new to $2,100,000 by the issuance of $300,000 in new stock, and will do this at once. Stockholders of record December 21 have the right to subscribe to one share for every six they hold at par. The company purposes to use the proceeds of this issue to make extensive improvements of its plants in New Haven and Bridgeport, Conn., and to extend its service to the surrounding towns.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES OF THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Jan. 13.	Jan. 6.
American Tel. & Tel. (New York)	139⅛	139½
Commonwealth Edison (Chicago)	143¾	143½
Edison Electric Illuminating (Boston)	286½	281
Electric Company of America (Philadelphia)	12	12
Electric Storage Battery common (Philadelphia)	54	53¾
Electric Storage Battery preferred (Philadelphia)	54	53¾
General Electric (New York)	183½	184
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅛	1¼
Massachusetts Electric common Boston)	16	16¾
Massachusetts Electric preferred (Boston)	76	76¼
National Carbon common (Chicago)	115	130
National Carbon preferred (Chicago)	117¼	117¼
New England Telephone (Boston)	159½	155
Philadelphia Electric (Philadelphia)	23	23½
Postal Telegraph and Cables common (New York)	86	80
Postal Telegraph and Cables preferred (New York)	67	66¾
Western Union (New York)	74¾	74⅝
Westinghouse common (New York)	77	78½
Westinghouse preferred (New York)	118	119½

*Last price quoted.

PERSONAL MENTION.

JAMES H. MASON, general manager of the Simplex Electrical Company, Boston, Mass., has left for an extended trip around the world.

F. W. INSULL, general auditor of the Arkansas Valley Railway, Light & Power Company, Pueblo, Colo., has resigned to accept another position.

D. D. MAXWELL, of Milwaukee, Wis., has been appointed manager of the properties of the Central Illinois Utilities Company, at Watseka, Ill., to succeed H. J. Frith, who has resigned.

E. HOLCOMB, manager of the Consumers' Power Company, St. Paul, Minn., has been elected president of the Minnesota Electrical Association for the year 1913.

H. W. GEE has been elected president of the Electrical Contractors' Association of Wheeling, W. Va. E. S. GODECKE has been elected vice-president, and W. J. BURRIS, Jr., has been elected treasurer.

N. C. DRAPER, manager of the Sioux Falls Light & Power Company, Sioux Falls, S. D., was recently elected president of the Dakota Club, a social organization having a membership of more than 200 Sioux Falls business men.

J. C. SYMMES, division superintendent of the Cumberland Telephone & Telegraph Company, was presented with a gold watch fob by Nashville business associates upon his leaving that city to attend to new duties at Atlanta.

S. E. BOWLER, Fort Worth, Texas, has been elected chairman of the Agricultural and Mechanical College branch of the American Institute of Electrical Engineers. E. S. LAMMERS, Jr., Dallas, has been elected secretary.

H. BARBER has resigned from the Hydro-Electric Department of the city of Hamilton, Canada, to take a position with the Toronto Hydro-Electric Commission. Mr. Barber is a graduate of the Toronto University in electrical engineering.

PRESIDENT THEODORE N. VAIL, of the American Telephone & Telegraph Company, is out of the hospital and back at his desk. Mr. Vail will soon go South and later make a trip to Europe. He will spend a good part of this year resting.

WALTER S. WELLER, employed by the Metropolitan Electric Company, of Reading, Pa., as an illuminating expert, has been appointed sales agent. Mr. Weller is a native of Kansas. Before going to Reading, two years ago, he was with the Hudson River Electric Company.

HUGH T. WREAKS, who for the past year has been acting as special agent on wires and cables for the Underwriters' Laboratories, Chicago, tendered his resignation, effective January 1, in order to devote his entire time to the work of the Wire Inspection Bureau, of which he is secretary.

SYDNEY W. ASHE, of the Harrison Lamp Works of the General Electric Company, addressed the Schenectady Section of the American Institute of Electrical Engineers on Tuesday, January 7. The subject of Mr. Ashe's discourse was "Some Fundamental Principles of Light Generation and Distribution."

A. A. ANDERSON has resigned as general manager of the Springfield Consolidated Railway Company and the Springfield Light, Heat & Power Company, of Springfield, Ill. He is succeeded by A. D. Furlong, general superintendent. Mr. Anderson went to Springfield from the Indianapolis & Louisville Traction Company in June, 1910.

G. M. LEMON, consulting engineer, Pittsburgh, Pa., addressed the Pittsburgh Section of the American Institute of Electrical Engineers on January 14 on "Maintenance of Operation During Construction." The annual banquet of the Pittsburgh section will be held on February 8, at the Hotel Schenley. RALPH D. MERSHON, president of the American Institute of Electrical Engineers, will be the guest of honor. H. D. LONGWELL, of the Westinghouse Machine Company, will preside.

S. P. GRACE, plant superintendent of the Central District and Printing Telegraph Company, has removed from Pittsburgh to Philadelphia, where he becomes engineer of outside plant of the Bell Telephone Company of Pennsylvania and associated companies. He is succeeded at Pittsburgh by B. STRYKER, formerly plant superintendent of the Bell of Pennsylvania at Harrisburg. Mr. Stryker has had an experience of 25 years in telephone plant work, beginning his career with the Chesapeake and Potomac Telephone Co. in Baltimore in 1888.

OBITUARY.

JAMES W. JOHNSON, district manager of the General Electric Company, Chicago, Ill., died of pneumonia after a very short illness, on the morning of Tuesday, January 14. Mr. Johnson began his electrical career as an office boy in the service of the old Bell Telephone Company under E. H. Eldred, its first manager. He later became cashier, under B. E. Sunny, resigning in 1885 to become a partner in the firm of Johnson, Holland & Company, composed of C. N. Fay, Claire Holland and himself. This firm was organized to exploit the storage battery business under patents owned by the Electric Accumulator Company of New York. Among its contracts was one for equipping the first three vestibule trains for the Pullman Company with electric lights. This firm was succeeded by the Northwestern Electric Accumulator Company, Mr. Johnson being made manager and treasurer. The business not meeting with the success expected, at Mr. Johnson's recommendation was honorably liquidated. In 1888 Mr. Johnson entered the employment of the Thomson-Houston Electric Company in its Chicago office, and a year later was made manager of the isolated lighting department. Later on he was made manager of the lighting department of the Chicago office of the General Electric Company, which had succeeded the Thomson-Houston Company. After the World's Fair Mr. Johnson left the General Electric Company and was for a time western agent for the United States Fire and Police Telegraph Company of Boston. He reentered the service of the General Electric Company in 1897, a year later being appointed manager of the power and mining department, Chicago office. In 1906 he was made assistant manager of the Chicago office, later on becoming district manager. He was a member of the Union League Club and the American Institute of Electrical Engineers. He was widely known in electrical circles. He was a man of tremendous capacity for work, of rare ability in the handling of men and in the execution of details. He had the unswerving devotion and esteem of his staff and his death comes as a severe blow to his family, friends and business connections. He was born at Waverly, New York, but was a resident of Chicago since boyhood.

James W. Johnson.

ISAAC LANSING JORALEMON, 72 years old, inspector of subways for the Interborough Rapid Transit Company, New York, died January 9 at his home in New York. Mr. Joralemon was formerly chief state inspector and later general inspector of Public Works at Yonkers, N. Y. He left a widow, a son, and a daughter.

DATES AHEAD.

Peoria Electrical Show. Peoria, Ill., January 18-25, 1913.

Ohio Engineers' Society. Columbus, O., January 21, 1913.

Electrical Contractors' Association of New York State. Annual meeting, Syracuse, N. Y., January 21, 1913.

Efficiency Society. Annual meeting, New York, N. Y., January 27-28.

Western Association of Electrical Inspectors. Annual meeting, St. Louis, Mo., January 28-30, 1913.

Minnesota Electrical Contractors' Association. St. Paul, Minn., February 1.

Electrical Supply Jobbers' Association. Quarterly meeting, Buffalo, N. Y., February 11-13.

American Institute of Electrical Engineers. Midwinter convention, New York, N. Y., February 26-28.

Minnesota Electrical Association. Annual convention, St. Paul, Minn., March 11-13.

Mississippi Electric Association. Annual convention, Natchez, Miss., April 21-23.

Iowa Electrical Association. Annual convention, Waterloo, Iowa, April 23-24.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29, 1913.

National Electric Light Association. Convention, Chicago, Ill., June 2-5.

National Electrical Contractors' Association. Annual meeting, Chattanooga, Tenn., July 16.

With the Electrical Manufacturers

The Thompson-Levering Company, Philadelphia, Pa., has moved to larger quarters at 323 Arch Street.

The Standard Electric Tool Company, Cincinnati, Ohio, has ready for distribution Bulletin U-7, describing and illustrating the "Standard" high-power universal portable electric drills.

The Diehl Manufacturing Company, Elizabethport, N. J., will exhibit in the National Printing and Advertising Exposition, which will be held in New York, April 19-26, at the Grand Central Palace. The company's printing press experts will be on hand to conduct visitors through the exhibition.

The Chelten Electric Company, 314 Armat Street, Philadelphia, is building a two-story addition. P. H. Ward, Jr., sales manager of the company, will make a trip the latter part of January to the Coast, returning by way of Denver and New Orleans, calling personally on the customers of the company.

Fred W. Nason Company, 39 Cortlandt Street, New York City, has issued a folder calling attention to some of the special switching appliances that he manufactures. A 10,000-ampere direct-current switch is illustrated. Among the other types of special switches made are multiple-point knife, end-cell, section and service switches.

Partrick, Carter & Wilkins Company, Philadelphia, Pa., has ready for distribution Catalog No. 26, describing and illustrating annunciators and electrical goods. This catalog is very complete and should be in the hands of every electrical contractor. There are a great many suggestions that may be gleaned from an examination of the contents of this catalog and copies will be sent to those interested upon request.

The Chicago Savings Bank & Trust Company, the well known depository and financial institution for Chicago electrical utility corporations and manufacturers, has made a conspicuous use of the painting, "The Heart of the City," with its January calendar. This painting is a startlingly realistic portrayal of busy city life, with its hurrying throngs, electric cars, delivery wagons, busses, and, in the distance, one of the lines of the celebrated Chicago "loop."

International Acheson Graphite Company, of Niagara Falls, N. Y., has appointed Richard Cary sales manager of its lubricant department. This department handles the lubricants known to the trade as Oildag, Aquadag and Gredag. The company's plans provide for a wider and more thorough distribution of its products, especially through the regular trade channels. By this means, and by thoroughly co-operating with the dealers, it is expected to materially broaden the business and enable users to procure these products without delay.

The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued bulletin No. 3313 which describes and illustrates its direct-connected electric forge blowers. Two types of direct-current blowers are made; one has a motor-speed regulator and is intended for individual forges only; the other has a constant-speed motor and is equipped with blast gates for operating two forges. The alternating-current blowers have single-speed single-phase induction motors and blast gates for one or more forges. The bulletin gives complete data of each type.

The Deane Steam Pump Company, Holyoke, Mass., and 115 Broadway, New York City, has issued catalog D-218 devoted to its electrically operated mine pumps. The catalog has 100 pages and over 60 finely engraved illustrations of the great variety of pumps described. Among these are duplex, triplex and quintuplex station-service pumps, duplex and triplex sinker pumps, triplex track pumps, many types of vacuum, slime and other pumps for milling and general service. Complete data is given for each type and much other useful information is included in the catalog.

The Baird Electric Score-Board Company, Chicago, Ill., has contracted to install in the baseball park in Louisville, Ky., owned by the Louisville Athletic Association, a member of the American Baseball Association, one of the biggest and finest electric scoreboards in the country. The indicating arrangement will enable every spectator to follow the official scoring of each play as rapidly as it is made, and will be so situated as to be visible from any portion of the park. The board itself will be 16 by 44 feet, in a frame 34 by 144 feet, the remainder of the space being occupied with advertisements. The results of other games in the Association circuit will be flashed from the press box to the park board, and every facility for describing the detailed scoring electrically will be provided.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued folder No. 4247, which covers the use of Westinghouse commutator cement for repairing commutators, and also gives directions for using it. This cement is composed of liquid and powder furnished in separate vessels, and is mixed according to specific directions. It is said that it sets quickly, possesses high insulation qualities, and is not affected by expansion or contraction.—Leaflet No. 3540 issued by the same company deals with Westinghouse type G synchronous motors for 60-cycle, two and three-phase circuits, various voltages, and from 30 to 250-horse power capacity. Thorough description of the various parts, together with illustrations are given. The advantages of these motors for driving pumps, fans, air compressors, and other machinery because they can incidentally raise the power-factor of the circuit are pointed out.—Westinghouse box-frame commutating-pole railway motors Nos. 317, 317-A, and 317-A 2 are very thoroughly described and illustrated in leaflet No. 3511. These motors are adapted for high-speed interurban service, and the A 2 motor is for use with field control.—Folder No. 4245 is devoted to the Westinghouse universal blow torch which is adapted to all conditions of service. A cross-sectional view of the torch illustrates its working parts, and the little folder describes the mechanism in detail.—"Saving the Tires Without Fire" is the title of a little folder describing the Westinghouse tire vulcanizer. Illustrations are shown of this device in operation and an account of its advantages and method of operation is also given. Particular emphasis is laid on the fact that no fire is required and therefore tires can be electrically vulcanized in the garage without danger.

Record of Electrical Patents.

Issued by the United States Patent Office, January 7, 1913.

1,049,330. Process of Extracting Vanadic Acid from Insoluble Copper Vanadate. W. F. Bleecker, Boulder, Colo., assignor to Rare Metals Mining & Milling Co. The material is dissolved in acid and copper separated therefrom by electrolysis.

1,049,333. Primary Battery. E. C. Brice, Mansfield, Ark. The carbon electrode is in the shape of a cup within which is a porous cup holding the zinc electrode.

1,049,337. Clamping Device. J. A. Burns, assignor to Westinghouse Electric & Manufacturing Co. For use in forming machine coils.

1,049,347. Primary Battery. G. S. Engle, Providence, R. I. The jar is of zinc and forms two compartments into which an inverted V-shaped carbon is hung.

1,049,354. Jewel Mounting. W. Godber, assignor to Westinghouse Electric & Manufacturing Co. The meter spindle and the stationary stem each carry a concave jewel between which is a hardened steel ball.

1,049,359. Electric Toaster. F. E. Hewitt, Toronto, Ont., Can. Has hinged sides on which the bread is laid horizontally and then turned vertically for toasting.

1,049,362. Fuse Housing. D. C. Hooker, assignor to Johns-Pratt Co., Hartford, Conn. A suspended petticoat insulator has a central socket for a pendent cartridge fuse surrounded by an insulating tube.

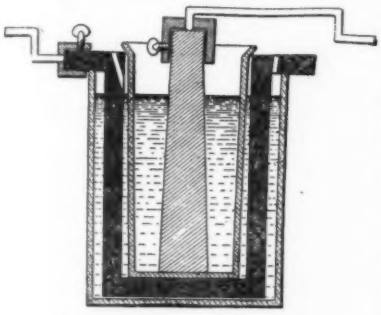
1,049,365. Mercury Meter. D. C. Jackson, Boston, Mass. An alternating-current wattmeter with compensation for frequency changes.

1,049,366. Protecting Device for Electric Circuits. R. P. Jackson, assignor to Westinghouse Electric & Manufacturing Co. A discharge gap for lightning arrester with two cylindrical electrodes containing fusible cores.

1,049,367. System of Electric-Motor Control. H. D. James, assignor to Westinghouse Electric & Manufacturing Co. An electromagnetic accelerator for a compound motor gradually cuts out the starting resistance, adds resistance to the series field and finally short-circuits the latter field.

1,049,370. Safety-Fuse. L. Kovacs, Chicago, Ill. A cartridge fuse set into special base receptacle.

1,049,371. Cutout Switch. L. Kovacs,



1,049,333.—Primary Battery.

Chicago, Ill. Has a cartridge fuse inclosed in each hinged knife blade.

1,049,375. Junction Box for Electrical Conduits. E. R. Le Manquais, assignor to National Metal Molding Co., Pittsburgh, Pa. For use with metal molding; has the side walls of the base and cover telescoping.

1,049,377. System of Electric-Motor Control. H. A. Lewis, assignor to Westinghouse Electric & Manufacturing Co. The control drum has adjustable contact.

1,049,403. Meter Switch. M. C. Rypinski, assignor to Westinghouse Electric & Manufacturing Co. Has a rotatively and axially adjustable contact arm.

1,049,404. Electrical Terminal. Y. Sakai, assignor to Westinghouse Electric & Manufacturing Co. A two-part insulating bushing surrounds the conductor and fits into a flanged aperture.

1,049,405. Insulator. F. Schaub, Jersey City, N. J. The body has a transverse wire recess and the cap has an annular recess registering with the other.

1,049,415. Electrical Operating Device. R. V. R. Sill, assignor to Secondary Controller Co., New York, N. Y. An electric steering device with master switch and pilot motor.

1,049,460. Controller for Electric Motors. J. Desmond, assignor to Artizan Brass Co., Chicago, Ill. Includes a pressure-controlled switch with a diaphragm.

1,049,484. Electric-Current Regulator. W. G. Houskeeper, assignor to Westinghouse Lamp Co. A constant-current transformer has several series transformers connected to its secondary and to their secondaries a shunted lamp load can be connected.

1,049,488. Electrical Heating Device. G. A. Hughes and T. M. Caven, assignors to Hughes Electric Heating Co., Chicago, Ill. A three-heat unit for electric stoves.

1,049,499. Receiver. O. M. Leich, assignor to Cracraft-Leich Electric Co., Genoa, Ill. A telephone receiver of the direct-battery type.

1,049,506. Alternating-Current Induction Motor. B. McCollum, Washington, D. C. A squirrel-cage motor with sections of cobalt in the conductor bars to give an abrupt rise in resistance at a critical current value and thus to limit the starting currents.

1,049,508. Fan Structure. F. P. Mies, Chicago, Ill., assignor to Plural System Ventilator Co. A reversing switch for the motor is operated at the same time as a valve that connects the fan alternately to two exhaust chambers.

1,049,516. Electrical Thermostat. M. Nemmert and G. Schnabel, Hamilton, Ont., Can. Includes a pair of expansion chambers containing mercury.

1,049,517. Electric Cooker. W. Nichols and C. V. Uzzell, Denver, Colo. An oven with a heating element on top and bottom is surrounded by a double-walled casing with ground-mica filling, the whole setting in a cabinet.

1,049,522. Electric Gas-Lighter. J. Y. Parke, Philadelphia, Pa. An oscillating conductor arm is adapted to engage a spring terminal.

1,049,526. Desk-Telephone Apparatus. N. Pedersen, assignor to Cracraft-Leich Electric Co. Relates to the switch-hook mechanism.

1,049,535. Weighing Machine. W. W. Rosenfield, New York, N. Y. Has two electric motors for moving the poise along the beam in either direction.

1,049,537. Selector. H. O. Rugh, assignor to Sandwich Electric Co., Sandwich, Ill. Electromagnets control the step-by-step rotation of a toothed sector and contact arm.

1,049,555. Arc Lamp. E. M. Wooden, New York, N. Y., assignor of one-third to A. B. Cavanagh. Special hand feed and adjustment for a projecting lamp.

1,049,557. Terminal Fastening. C. W. Beck, assignor to Michigan Motor Specialties Co., Detroit, Mich. For connecting to the stem of a spark plug.

1,049,558. Block Signal and Train Control System. J. Blackburn, Kirkwood, Mo. Electric release for a mechanically wound semaphore.

1,049,562. Lamp Socket and Switch Device. C. G. Burton, Peru, Ind. A combined socket and shade, the rotation of which actuates the switch.

1,049,568. Chronometer-Controlled Signaling Device for Telephone-Exchange Systems. I. D. Fellows, Syracuse, N. Y., assignor of one-half to J. H. McCartney. A spring motor operates a sound signal when the line has been in use for a predetermined time.

1,049,576. Trolley Support. W. Hadden, Crafton, Pa. A bowed framework for holding the wheel.

1,049,577. Speed-Changing, Reversing, and Braking Gearing. E. Halma, assignor to himself, G. L. O. Perret and L. L. Murisier, Paris, France. An epicycloidal gear train with a revolving electromagnetic clutch and a stationary electromagnetic brake.

1,049,586. Automatic Fire-Alarm. F. Koup, Syracuse, N. Y. Attached to a socket is a cylinder with a fusible circuit-closing cap.

1,049,594. Press for Molding Insulators or Similar Articles. S. Olsen, assignor to Brookfield Glass Co., Old Bridge, N. J. Describes the mold, molding plungers and actuating mechanism.

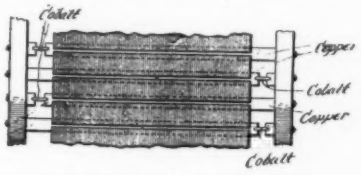
1,049,608. Apparatus for Handling Eggs. T. H. Ryan, San Francisco, Cal. Includes a light well containing incandescent lamps.

1,049,609. Spring Fastening Device. J. Schade, Jr., assignor to Fahnestock Electric Co., Brooklyn, N. Y. A V-shaped loop and R-shaped spring clip for holding wire terminals.

1,049,624. Means for Joining Electrodes. E. Viertel and H. Viertel, assignors to Gebrueder Siemens & Co., Lichtenberg, Germany. The ends to be joined are internally threaded and connected by a nipple.

1,049,636. Electric-Circuit Controller. H. M. Abernethy, assignor to American Railway Signal Co., Cleveland, O. A cylinder with several independent adjustable segmental contact rings.

1,049,657. Trolley-Pole Clamp. L. G. Bowen, Kansas City, Mo. For mounting the pole on top of the car.



1,049,506.—Squirrel-Cage Rotor.

1,049,686. Automatic Switch Mechanism for Electric Locomotives. R. R. Dunlop, Columbus, O., assignor to Jeffrey Manufacturing Co. A mining locomotive has three supply conductors for the motor and switches to connect in only one at a time.

1,049,687. Flame Arc Lamp. H. G. Dyer, Collingswood, N. J. About the arc is a chimney whose top and bottom are externally connected by a conduit.

1,049,703. Induction Motor. A. M. Gray, assignor to Allis-Chalmers Co., Milwaukee, Wis. At starting the rotor is connected to slip rings and then to short-circuiting rings.

1,049,708. Automatic Electric Cutout. J. H. Hallberg, New York, N. Y. For connecting a resistance into the lamp circuit when the lamp is broken.

1,049,729. Suction-Creating Pump for Cleaning and Scrubbing Machines. C. A. Kaiser, assignor to B. Beecher, Philadelphia, Pa. Driven by an electric motor.

1,049,750. Electric Heating-Stove. A. E. Mastin, Sacramento, Cal. Has two lower chambers and an upper chamber with a heating unit in each lower chamber.

1,049,752. Electrical Wiring Apparatus. A. McMurtrie, assignor to Thomas & Betts Co., New York, N. Y. A

round insulating head for conduit is held thereto by a threaded collar with two arms.

1,049,759. Electrotherapeutic Appliance. W. B. Oliver, assignor to Oliver Electric Co., Philadelphia, Pa. A massage outfit with two electrode rollers held at right angles to a handle containing an induction coil.

1,049,771. Conduit for Electrical Conductors. F. D. Saylor, Pittsburgh, Pa. A flexible duct consisting of an inner textile tube with a tarry coating, spirally wound flexible ribbon and an outer coating of mica and glue.

1,049,775. Apparatus for Producing Electrical Discharges. R. Spaulding, assignor to M. Spaulding, New York, N. Y. An electric fan drives air past screens and high-tension electrodes.

1,049,786. Incandescent Lamp. E. Weintraub, assignor to General Electric Co. Consists of a V-tube containing a little mercury and a concentric filament thickened at the bend.

1,049,787. Process of Preparing Matrices for Electrotyping. W. H. Welsh, Collingswood, N. J., assignor of one-half to H. E. Kendig. The wax matrix is maintained at 45 to 60 degrees Fahrenheit while blacklead is applied to the entire surface by a series of sharp distributed blows.

1,049,801. Electric-Furnace Lining. F. M. Becket, assignor to Electrometallurgical Co., Niagara Falls, N. Y. The facing consists of ferrotungsten.

1,049,822. Antiseptic Protector for Mouthpieces. E. A. Dieterich, New York, N. Y. Has an endless web between two rollers to which is applied an antiseptic and powdered perfume.

1,049,825. Combined Wire-Puller and Fish-Tape Guide. O. F. Dubruiel, Duluth, Minn. Consists of two hollow caps fitting one within the other, the inner having a hole in its closed end and a cross bar for the wire or tape.

1,049,826. Gathering Locomotive. R. R. Dunlop, assignor to The Jeffrey Manufacturing Co., Columbus, O. Has a motor-driven cable reel for winding the supply cable for the propulsion motor.

1,049,833. Sign and Indicator. P. Ficcio, Tampa, Fla., assignor of one-half to V. Ficcio. Includes a number of lamps, contacts therefor and battery.

1,049,839. Appliance for Electroplating Plants. J. A. Fraser, Benton Harbor, Mich. A shaft and hoisting device for raising the work.

1,049,843. Motor-Operated Crossing-Gate. J. J. Gard and E. G. Ruthrauff, assignors to Buda Foundry & Manufacturing Co., Chicago, Ill. Includes a reversing electric motor.

1,049,845. Electromagnetic Valve. H. G. Geissinger, assignor to Geissinger Regulator Co., New York, N. Y. The plunger of a solenoid operates a gate valve.

1,049,854. Luminous or Flaming Arc Electrode. J. L. R. Hayden, assignor to General Electric Co. Contains titanium carbide and cerium titano-fluoride.

1,049,894. Pumping System. W. L. Merrill, assignor to General Electric Co. Includes an electric motor for driving two centrifugal pumps and several motors for operating valves in accordance with pressure.

1,049,915. Prepayment Attachment for Instruments. J. L. Post, Canon City, Colo. Includes an electric signal and control circuit.

1,049,918. Insulating Material. E. W. Rice, Jr., assignor to General Electric Co. Commutator insulation consists of thin layers of mica and "commutite."

1,049,920. Electric Metal-Working Apparatus. A. F. Rietzel, assignor to Thompson Electric Welding Co., Lynn, Mass. Two transformer secondaries are connected in series by heavy terminal bars between which the welding electrodes operate.

1,049,945. Attachment Plug. S. Trood, assignor to Bryant Electric Co., Bridgeport, Conn. The swiveling screw shell has an internal sleeve engaging a side contact.

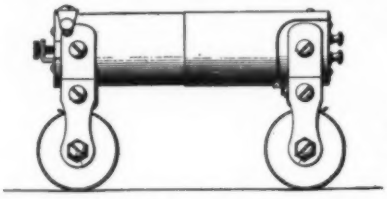
1,049,952. Water-Level-Indicating System. A. B. Walton, Lorain, O. Has paired electrodes at different heights connected to an electric indicator.

1,049,957. Friction Clutch. A. W. Whitcomb, Worcester, Mass. An electromagnet on one part engages an armature on the other.

1,049,961. Battery. R. C. Wood, New York, N. Y. Describes the method of supporting plates of copper oxide.

1,049,962. System of Electrical Supply. W. C. Woodland, Warren, O. A transformer has a reactance in each primary and secondary circuit, these maintaining the power-factor constant regardless of the number of secondary-circuit lamps.

1,049,975 to 1,049,978. Electric Switch. F. Barr, New York, N. Y.



1,049,759.—Electric Roller Massage Outfit.

The first three patents relate to various details of a key switch for a lamp socket. The fourth patent covers a flush wall pull switch.

1,049,979. Electric Furnace Member and Process of Making It. F. M. Becket, assignor to Electrometallurgical Co. The furnace body is of carbon on which is a facing of ferrotungsten.

1,050,000. Trolley-Contact Signal or Switch System. T. Cope, New Waterford, O. Passage of a car controls distant signals.

1,050,002. Electric Igniting Device for Explosive Engines. E. P. Cowles, Sparta, Mich. An ignition magneto is combined with the engine flywheel.

1,050,004. Implement for Installing and Repairing Electric Conductors. J. Cronin, assignor to The Cronin Electrical Appliances Co., Wapakoneta, O. Comprises a rectangular frame vertically adjustable on a sliding rod and laterally adjustable arms.

1,050,019. Electrode. J. L. R. Hayden, assignor to General Electric Co. A flaming-arc electrode composed of carbon and calcium titano-fluoride.

1,050,020. Electric-Lamp-Supporting Means. R. Herman, Crafton, Pa. For raising and lowering an arc lamp on a lamp-post.

1,050,021. Electric Switch. E. M. Hewlett and C. C. Badeau, assignors to General Electric Co. Distant mechanical control for an oil switch through a taggle, bell-crank levers and rods.

1,050,026. Starter for Combustion Engines. C. Hunt, Indianapolis, Ind. Includes an electromagnetically actuated valve.

1,050,062. Electrical Fuse-Plug. J. S. Johnston, assignor to Johnston Manufacturing Co., Utica, N. Y. A cartridge fuse of special internal construction.

1,050,068. Lamp-Cord Adjuster. F. C. Mezger, Gatum, Canal Zone. Includes two frames with slack-cord pulleys.

1,050,072. Arc Lamp. W. Ruhling, Berlin, Germany. The electrode sets are parallel and between each pair is an insulating barrier composed of flux that renders the slag volatile in the arc.

1,050,081. Line-Drop Compensator. J. Pearson, Somerset, Wis., assignor of one-third to J. F. Williamson and one-sixth to F. D. Merchant. Has two circuits from a polyphase line, one for voltage and the other for current, the latter including a phasing transformer.

1,050,082. Method of Line-Drop Compensation. J. Pearson, Somerset, Wis., assignor of one-third to J. F. Williamson and one-sixth to F. D. Merchant. The current in one of the two circuits derived as above is transformed to increase the phase difference and then the two currents are combined to produce a resultant regulating current.

1,050,085. Electrically Driven Machine for Tilling the Ground. W. Wortmann, Mayence, Germany. Mounted on the truck is a vertically swiveled reel for paying out an electric cable.

Patents that Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 14, 1913:

552,897. Messenger, Call System for Buildings. H. Denver, Springfield, Mass.

552,924. Electric Releasing Device. S. M. Reynolds, San Jose, Cal.

552,933. Electric Bell. C. B. Sterling, New York, N. Y.

552,954. Automatic Electric Releasing Device. J. W. Chute, San Jose, Cal.

552,961. Electric Motor. D. C. Jackson and C. M. Conradson, Madison, Wis.

552,967. Electric Arc Lamp. L. G. Nilson, Sioux City, Ia.

552,972. Telephonic Apparatus. C. J. Schwarze, Adrian, Mich.

552,982. Electric Arc Lamp. F. J. Borland, Leeds, England.

553,014. Electric Circuit Connector. T. F. Nevins, Brooklyn, N. Y.

553,035. Driving Mechanism for Bicycle Dynamos. G. Mayer, Brooklyn, N. Y.

553,058. Street Indicator. C. Eby, Rocky River, O.

553,099. Bonding Device for Electric Railways. W. Brown, Camden, N. J.

553,106. Automatic-Closing Telegraphic Key. J. A. Coleman, Perry Station, Canada.

553,176. Electric Railway. T. F. O'Connor, New York, N. Y.

553,179. Telephone Circuit. E. Slade, Newton, Mass.

553,194. Clip for Supporting Electric Cables. R. H. Lewis, Providence, R. I.

553,198. Automatic Lighting or Extinguishing Apparatus. S. C. Stickle, New York, N. Y.

553,220. Electric-Lamp Support. J. Buckner, Boston, Mass.